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American Journal of Diseases of Children

VOL. 28 JULY, 1924 NO. 1

CAUSES AND TREATMENT OF OTITIS MEDIA

I. OBSERVATIONS ON TWO HUNDRED AND FIVE CASES OCCURRING IN SIX HUNDRED AND THIRTEEN CONSECUTIVE HOSPITAL ADMISSIONS *

DAVID T. SMITH, M.D.
BALTIMORE

During my service as house officer in the Harriet Lane Home I was impressed by the frequency and severity of otitis media among infants and young children. The methods of treatment being used at that time were not entirely satisfactory. In some cases the discharge from the ears ceased rapidly; in others it continued for weeks, months, and even years. This study was undertaken with the hope that some of the factors determining the greater susceptibility of the very young might be found, and a logical and efficient treatment instituted. The marked variations in the duration and severity of the disease made it necessary to study a large series of control cases before attempting to evaluate any new method of treatment.

Records of all patients entering the hospital were kept during a six-month period, extending from February 6 to Aug. 6, 1923. The ear drums of each patient were examined with care by an experienced physician at the time of admission. The records were complete in 613 cases. Of these, 205 patients (33.4 per cent.) either had otitis media at the time of admission or contracted it while in the hospital. Nearly one-fourth of the patients (22.5 per cent.) entered with this disease. Of those who were free from middle ear infection at the time of admission, and who stayed in the hospital more than four days, sixty-five or 15 per cent. developed the disease. Forty-one patients (7 per cent.) showed only redness of the drums, which cleared up without myringotomy, after treatment with phenol (carbolic acid) and glycerin (10 per cent. phenol in glycerin). In the remaining cases the drums had either ruptured before admission or were opened in the hospital.

These records were analyzed and classified in an effort to obtain some knowledge of the predisposing etiologic factors involved in otitis media. The patients came largely from the homes of the poorer classes in the more congested districts of Baltimore, and almost all were artificially fed. Apparently the race and sex of the patient had no

* Received for publication, March 25, 1924.

* From the Department of Pediatrics, Harriet Lane Home for Invalid Children, Johns Hopkins Hospital.

causal influence. Among 171 negro patients there occurred fifty-seven cases (33.3 per cent.); while among 430 white patients there were 146 cases (33.9 per cent.). But the incidence of otitis did vary with: (1) the season of the year, (2) the age of the patient and (3) the type of the associated disease.

SEASONAL VARIATION

In Table 1 is shown that there is a seasonal variation which corresponds roughly to that of the other acute respiratory diseases. In this series there is a gradual decline of incidence from 47.3 per cent. in February to 23.6 per cent. in July. It is significant that even in July, which was the last month included in the period of observation, nearly one-fourth of the patients had this infection.

TABLE 1.—*Seasonable Variations by Months*

Month	No. of Patients	Cases of Otitis	Percentage
February	131	62	47.3
March	96	38	39
April	97	27	28
May	99	28	28
June	91	24	25
July	98	22	23.6
Total	607	201	33.1

AGE OF THE PATIENT

The most important single factor in the susceptibility to otitis media is the age of the patient. Pediatricians know from experience that it is the younger children who develop otitis. But these studies seem to

TABLE 2.—*The Effect of Age on the Incident of Otitis*

Age Period	Number of Patients	Otitis on Admission		Developed in Hospital		Total Percentage Otitis
		Number	Percentage	Number	Percentage	
0- 3 months	73	7	9.5	9	19	22
3- 6 months	54	18	33	13	39	57
6- 9 months	47	17	36	12	46	61.6
9-12 months	46	17	37	7	24	52.2
1- 2 years	106	38	36	11	18	47.6
2- 3 years	73	23	31	6	13	39.7
3- 5 years	44	9	20	3	9	27.2
5-10 years	107	4	3.7	4	3.8	7.4
10-14 years	40	0	0	0	0	0
All ages	487	133	22.5	65	15	33.7

show that it is not the very young infants, but those between the ages of 3 and 15 months who are most susceptible. More than one-half of the children in this age group developed the infection. Table 2 records a rise from 22 per cent. before the third month, to 61.6 per cent. between the ages of 6 and 9 months, with a gradual fall to 7.4 per cent. between the ages of 5 and 10 years. This marked age variation is shown not only on admission but also by the children who are attacked by otitis while in the hospital; thus indicating that the occurrence

of the disease depends on some fundamental factor which is more or less independent of environment.

The relatively high percentage of children between the ages of 3 and 9 months who developed otitis while in the hospital was unexpected, in view of the care exercised by the nurses and interns in handling the infected cases. During a large part of the period in which these observations were made, the nurses and interns wore gauze masks over the nose and mouth when feeding or examining patients without infection, in an effort to prevent the spread of colds and otitis. All the efforts were valueless, as colds and subsequent ear infections continued to occur.

An examination of the records reveals that otitis did not run a more prolonged course in these very susceptible children between the ages of 3 and 15 months. When otitis occurred, it continued for about the same length of time regardless of the age of the patient. There was

TABLE 3.—*The Effect of the Associated Disease on the Incident of Otitis*

Disease	No. of Patients	Cases of Otitis	Percentage
Pneumonia	133	75	56
Scarlet fever	39	6	16
Dysentery	34	17	50
Tuberculosis	31	9	29
Rickets	30	18	60
Prematurity	27	4	15
Pharyngeal and laryngeal diphtheria	25	9	36
Regulation of feeding	24	8	33
Acute intestinal indigestion	19	8	42
Heart disease	17	0	0
Nasal diphtheria	16	8	50
Pertussis	13	7	53
Nephritis	12	2	16
Chorea	11	0	0
Pyelitis	6	5	83
Meningitis (not tuberculous)	6	4	66
Miscellaneous	170	35	20
Total	613	205	33.4

a slight but definite increase in the death rate among the patients with otitis at the susceptible age period. This was balanced, however, by the relatively high death rate among the prematurely born infants and the patients with cardiac trouble, who had practically no ear infections, so that the percentage was almost the same (17 per cent.) in those with otitis and those without otitis.

TYPE OF THE ASSOCIATED DISEASE

It has always been known that otitis media occurs more frequently with some diseases than with others. Table 3 shows the association of this condition with other diseases in 613 patients. Pneumonia, dysentery, nasal diphtheria, pertussis and pyelitis all show complicating otitis in 50 per cent. or more of the patients. Prematurity, nephritis, and the miscellaneous group (which was composed largely of noninfectious conditions) showed 20 per cent. or less, accompanying ear infections. The low percentage of incidence in the thirty-nine cases of scarlet fever

(16 per cent.) is probably explained by the fact that 90 per cent. of the patients were over 5 years of age and therefore not very susceptible. Those with heart disease and with chorea had no otitis.

The percentage of otitis in each age group is represented by the solid black line in Chart 1. During the first 3 years of life, patients with pneumonia show an incidence of otitis which is seen to follow almost the same type of curve as the average but at about a 20 per cent. higher level. After the fourth year, the presence of pneumonia seems to have little influence on the percentage of otitis. The other acute infections show the same type of curve as pneumonia but with values very much closer to the average. The miscellaneous cases are represented by a line which parallels the average but at about a 15 per cent. lower level. Probably the type of curve is due to some fundamental factor

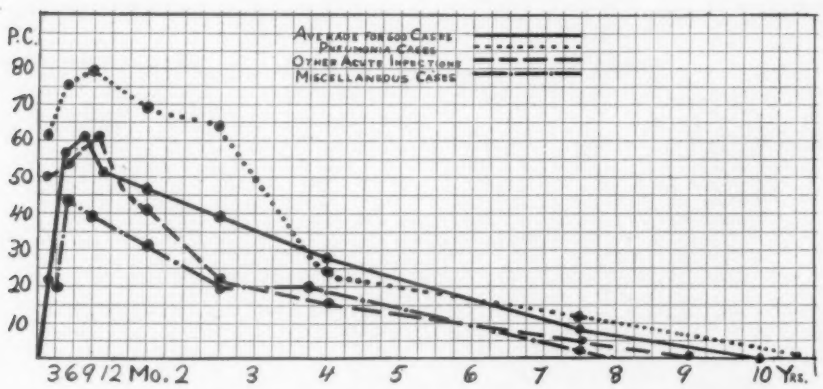

Chart 1.—The effect of the associated disease on the otitis curve.

which is associated with the age of the patient, but the levels at which the different lines run is determined by the specific effect of the accompanying disease.

BACTERIOLOGY

Cultures of the aural discharge were made from fifty patients with otitis media. Some were taken directly after opening the ear drums; others one, two, or even three weeks after the discharge had begun. In Table 4 it is to be noted that hemolytic streptococci [1] were found in pure culture in 50 per cent. and mixed with other organisms in 6 per cent. of the cases. Streptococci and staphylococci were the most

1. In the discharge from the ears, the organisms were nearly always in diploforms, suggesting pneumococci. But when grown on plates they exhibited both short and long chains. The colonies were moist and rather mucoid and produced a large clear zone of hemolysis on human blood agar. Some of the strains were tested with bile and found to be insoluble. Insulin fermentation tests were not done.

frequent micro-organisms. Pneumococci, contrary to our expectations, were found infrequently even when the otitis was a complication of pneumonia.

DURATION OF THE DISEASE

The length of time the ears discharged varied from one day to five months. The infection was treated with bichlorid of mercury irrigations in 146 cases.[2] Forty-three of these patients either left the hospital and could not be traced, or died before the ears had been discharging longer than seven days. One case, which had continued for months before admission, was in a patient who had extensive pulmonary tuberculosis and was probably tuberculous in origin, although the bacilli were never found in the discharge. Two patients were admitted for mastoid operations. These forty-six cases, where the irrigation method of treatment was not given a fair trial, were not included in the statistics. In the remaining 100 cases seventy-four (74 per cent.) were cured without

TABLE 4.—*Bacteria Found in Fifty Cultures*

Type of Organism	Number of Cases
Hemolytic streptococci	25
Hemolytic streptococci and B. pyocyaneus	2
Hemolytic streptococci and B. coli	1
Staphylococcus aureus	5
Staphylococcus aureus and B. influenzae	1
B. coli	4
B. vulgaris	1
B. lactis aerogenes	1
B. diphtheriae	1
Diphtheroid	1
Pneumococcus and diphtheroid	1
Fusiform bacilli and spirilla of Vincent's angina	1
Mixed cultures containing three or more forms	6
Total	50

operation. Four patients were cured after mastoid operations. Eight died with the ears still discharging. Fourteen left the hospital with the ears still discharging and could not be traced. The average time of discharge for these 100 cases was 25.5 days. The irrigations were given by competent nurses under the direct supervision of the resident house officers, consequently the poor results can be attributed to the intrinsic defects of the method and not to the manner of application.

COMMENT

This study emphasizes the fact that it is children between the ages of 3 and 15 months that are most likely to develop otitis media; it is necessary to discover the cause of this great susceptibility before we can hope to prevent the disease.

2. With an ear bulb the external ear was irrigated with a 1:10,000 solution of bichlorid of mercury, which had been warmed to body temperature, until the fluid returned free from pus. Then the bichlorid solution was washed out with a normal saline solution. The procedure was repeated from three to six times in twenty-four hours, depending on the severity of the case.

The possibility should be considered that otitis media may be in some way associated with a vitamin deficiency, probably by the lowering of tissue resistance. Practically all of the children in this series were on artificial feedings and most of them had received little, if any, cod liver oil before admission. The age period where the susceptibility is greatest corresponds rather closely to that shown for rickets and scurvy. Sixty per cent. of the thirty patients with rickets had otitis media. The seasonal variation of otitis could be related to that of rickets quite as well as to the seasonal variation of the acute respiratory diseases.

Daniels, Armstrong and Hutton [3] (1923) reported that rats fed on a diet deficient in fat-soluble A vitamin developed otitis media and nasal sinusitis as well as xerophthalmia. Animals that were fed on diets deficient in vitamin B and on low calcium diets did not acquire infections of the middle ear. Further experimental work along this line is needed to confirm these observations.

The frequency with which streptococci were isolated from early cases, the high incidence of the disease in hospitals for children, and the occurrence of several cases in succession in isolated family groups suggests that otitis media may, under some conditions, become a contagious disease. Indeed, Reeder [4] (1921) reported a small epidemic of otitis media and mastoiditis, due to streptococci, which occurred at one of the training camps during the war.

CONCLUSIONS

1. In 613 admissions, 33.4 per cent. of the children either had otitis media when they came in or developed it while in the hospital.

2. The race and sex of the patient seemed to have no relation to the incidence of the disease.

3. There was a definite seasonal variation. In February, 47.3 per cent. of the patients had otitis media; in July only 23.6 per cent. of the children were attacked.

4. The most susceptible period was between the ages of 3 and 15 months. In this group more than 50 per cent. of the children had otitis media.

5. Patients with pneumonia, dysentery, nasal diphtheria, pertussis and pyelitis developed otitis media in 50 per cent. or more of the cases. Those with the condition of prematurity, nephritis and the noninfectious diseases showed ear infections in less than 21 per cent.

6. Hemolytic streptococci were isolated from the aural discharge in 56 per cent. of the fifty cases cultured.

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3. Daniels, A. L.; Armstrong, M. E., and Hutton, M. K.: Nasal Sinusitis Produced by Diets Deficient in Fat-Soluble A Vitamin, J. A. M. A. **81**:828 (Sept. 8) 1923.

4. Reeder, J. E.: Epidemic Mastoiditis, Ann. Otol., Rhinol. & Laryngol. **30**:551 (June) 1921.

7. The average duration of the disease in 100 cases was twenty-five and one-half days.

II. RESULTS IN EIGHTY-EIGHT CASES TREATED WITH SYNTHETIC DRUGS AND DYES

The foregoing observations have emphasized the high incidence of otitis media in children between 3 and 15 months of age. It has shown also that treatment with bichlorid irrigations is far from satisfactory. In 100 cases treated by this method seventy-four patients were cured, four required mastoid operations, and twenty-two either died or were lost sight of while the ears were still discharging. The average duration of the disease in the 100 cases was twenty-five and one-half days.

A number of drugs and dyes were considered in an effort to find some one or some combination that would kill the organisms causing the disease without injuring the delicate structures of the ear. Miss Justina H. Hill, bacteriologist for the Brady Urological Institute, has

TABLE 5.—*Bactericidal Power of Drugs in 50 Per Cent. Serum Exposed to Drug for One Minute*

	Organism			
	B. coli	Staph. aureus	B. pyocyaneus	B. pneumoniae
Na hydroxy-mercuri-benzophenone sulphonate	1:10,000	1:600	1:300	1:4,000
Mercurochrome-220 soluble	1:200	1:90	1:90	1:50
Mercuric chlorid	1:10,000	1:3,000	.....	.....
Acriflavine	1:200 fails	1:200 fails	.....	.....

made extensive tests of the bactericidal and bacteriostatic effect of a number of the newer antiseptics. Some of the cultures used in her experiments were originally isolated by me from cases of otitis media. The results of her work are summarized in Tables 5 and 6. The relative value of the different drugs in their action on various bacteria has been confirmed in the Harriet Lane Home by clinical and bacteriologic observations on the fate of bacteria in otitis media when treated with antiseptics. On the basis of these experiments and observations a new method of treatment has been evolved which will be presented in this article.

MATERIAL

The patients selected for the new treatment came from three sources: (1) every fifth case that came into the hospital during a six month period;[5] (2) patients with otitis media who came to me in the routine dispensary work; and (3) the cases in the dispensary which the other physicians were unable to cure rapidly with boric acid or

5. The cases of otitis media occurring among the other four-fifths of the hospital admissions were treated with bichlorid irrigations and form the control referred to in this paper.

bichlorid irrigations. There were twenty-five patients in the first group, thirty in the second, and thirty-three in the third group. It is seen that one-third were hospital cases, one-third routine dispensary cases, and one-third difficult or resistant cases. The irrigations in the hospital were given by the nurses; those required for the dispensary cases were given by the mothers of the patients.

METHOD

The mechanical problem in the treatment of otitis media is of vital importance. The pus must be cleaned from the external ear, and the antiseptic introduced into the middle ear where it can act directly on the organisms causing the disease. One of the difficulties with the ordinary method of treatment is the fact that only the external canal is treated; the organisms in the middle ear are not reached. After trying a number of solutions it was found that ordinary commercial hydrogen peroxid diluted one-half with water was the most efficient irrigating fluid.

In order to obtain good results from irrigations it is necessary to have a long, clean incision in the tympanic membrane, preferably in the posterior inferior quadrant. An ordinary medicine dropper with a good stout rubber bulb is the most useful and practical instrument to use. The peroxid liquefies the pus and at the same time serves as an indicator of the presence of more pus. So the mothers and nurses were instructed to irrigate the ears until the peroxid no longer frothed. If the drums were open and the irrigation was carried out properly, the pus would be cleaned from the middle ear as well as from the external canal. After the irrigation, the excess of fluid in the external canal was removed by swabbing with a little cotton. Then with a clean medicine dropper a few drops of the prescribed antiseptic were dropped into the external canal. The drug penetrates into the middle ear and attacks directly the organisms responsible for the discharge.

The theoretical objection which has been raised to peroxid irrigations, that the liberation of oxygen in the middle ear may force organisms into the mastoid cells, is adequately answered by the practical results. Not a single case of mastoiditis developed in a series of seventy-five acute and chronic cases which were irrigated with this solution. Bozer (1923)[6] reported the use of peroxid irrigations without complications in 190 cases of chronic otitis in adults.

SODIUM HYDROXY-MERCURI-BENZOPHENONE SULPHONATE

It is to be noted in Table 6 that sodium hydroxy-mercuri-benzophenone sulphonate [7] kills colon bacilli, even in the presence of 50

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6. Bozer, H. E.: Chronic Suppurative Otitis Media, Ann. Otol., Rhinol. & Laryngol. **32**:277 (March) 1923.

7. Young, H. H.; White, E. C.; Hill, J. H., and Davis, D.: Surg. Gynec. & Obst. **36**:508-521 (April) 1923.

per cent. serum, in a concentration which it is theoretically possible to obtain in the middle ear. Another advantage of this drug lies in the fact that it does not stain tissue or clothing. An 0.5 per cent. solution in distilled water was found to be the highest concentration that could be used in the ear without causing discomfort to the patient.

TABLE 6.—*Bacteriostatic Action of Drugs in Broth*

	Organism			
	Staph. aureus	B. pyocyaneus	Streptococci	B. coli
Acid fuchsin	1:100 fails	1:100 fails	1:100 fails	1:100 fails
Argyrol	1:5,000	1:5,000	1:10,000	1:10,000
Acetic acid	1:4,000	1:4,000	1:1,000	1:2,000
Na hydroxy-mercuri-benzophenone sulphonate	1:90,000	1:2,000	1:40,000	1:90,000
Acetic and sodium salt	1:50,000	1:20,000	1:50,000	1:60,000
Neutral acriflavine	1:400,000	.....	1:450,000	1:150,000
Gentian violet	1:2,000,000	1:2,000	1:150,000	1:100,000
Neutral acriflavine and gentian violet	1:2,000,000	1:10,000	1:450,000	1:100,000
Mercuric chlorid	1:1,500,000	1:50,000	1:600,000	1:750,000

The drug deteriorates rapidly in solution and a new supply must be made up every five or six days. For use in the first half of the series fresh solutions were obtained from the Brady Urological Institute through the kindness of Dr. Hugh H. Young. The inconvenience of having to weigh out the drug every time a fresh solution was desired was eliminated, in the last half of the series, by its use in the form of tablets. By dropping from one to three of these tablets into 1 ounce (30 c.c.) of distilled water any desired strength of the drug could be made with ease. The solutions made with the tablets were just as efficient as those made directly from the fresh powder.

After the ears had been thoroughly cleaned of pus by peroxid irrigations, 10 or 15 drops of an 0.5 per cent. solution of sodium hydroxy-mercuri-benzophenone sulphonate was introduced into the external canal with a medicine dropper. The antiseptic was washed back and forth by alternately aspirating and forcing out the solution into the deeper part of the canal. By this procedure the drug was forced through the opening in the drum into the middle ear where it could act directly on the organisms. The treatment was repeated three or more times during the twenty-four hours, depending on the severity of the case.

It was soon found that the results of treatment with the drug were very irregular. Some cases cleared up readily in two or three days; others showed no improvement whatever over the controls. The explanation for this variability was made evident by the bacteriologic findings. The cases that showed colon bacilli in the discharge cleared up rapidly. Those showing streptococci were somewhat improved; while those with staphylococci, gram-positive diphtheroids, diphtheria bacilli, and

pyocyaneus bacilli were not improved at all. Argyrol and acid-fuchsin were likewise useless in the treatment of otitis associated with these organisms.

GENTIAN VIOLET

With the exception of pyocyaneus, all the organisms mentioned in the group that was resistant to the sodium solution were gram positive. This suggested the use of gentian violet which Churchman (1918)[8] introduced into therapeutics for the treatment of infections caused by gram-positive bacteria. It was found that gentian violet was not irritating when introduced into the ear. One, 2, and even 5 per cent. solutions could be used with safety.

At first Sterling's gentian violet was used which was prepared in the same manner as for use in Gram's stain. Later the anilin oil was eliminated from the formula. Finally a very satisfactory solution was obtained by dissolving 5 gm. of gentian violet in 20 c.c. of 95 per cent. alcohol and then diluting with distilled water to make 100 c.c. This solution keeps well for a month or more. Dilutions could be made from this stock just before use.

The great disadvantage of gentian violet is its staining properties. It is almost impossible to prevent it getting on the face, hands and clothing of the patient. It is readily soluble in alcohol, however, and may be removed from the face and hands by swabbing the stained area with a little cotton which has been soaked in alcohol. Much protection from the staining may be had by using only two or three drops of the dye in the ear after the peroxid irrigations, and by having the patient wear a loose pad of cotton over the ears at night covered by a close fitting nightcap. After several applications of the drug, the ear drums are deeply stained and the staining persists for ten days or two weeks after the treatment has been discontinued. Apparently the hearing is not impaired in the slightest degree by the treatment.

The results of treatment were excellent when the organism involved was a staphylococcus, diphtheroid or pneumococcus. Cases caused by streptococci were somewhat improved, while those associated with pyocyaneus were not improved. Gentian violet, of course, had no action on the gram-negative organisms of the colon group.

It is seen that one antiseptic, sodium hydroxy-mercuri-benzophenone sulphonate, acts mainly on the gram-negative organisms found in the ear, and another, gentian violet, acts largely on the gram-positive ones. An attempt was made to mix the gentian violet with the sodium solu-

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8. Churchman, J. W.: Treatment of Acute Infections of the Joint by Lavage and Direct Medication, J. A. M. A. **70**:1047 (April 13) 1918; Selective Bacteriostasis in the Treatment of Infections with Gentian Violet, J. A. M. A. **74**:145 (Jan. 17) 1920. Bacteriostasis by Mixture of Dyes, J. Exper. Med. **38**:1 (July) 1923.

tion, but this was not successful because gentian violet was precipitated by the mercury contained in the solution. Using the two drugs alternately, however, was entirely satisfactory and this was the method employed in most of the eighty-eight cases reported in this article.

ACETIC ACID

Pyocyaneus was the one organism that seemed absolutely resistant to both gentian and the sodium solution. At the suggestion of one of the

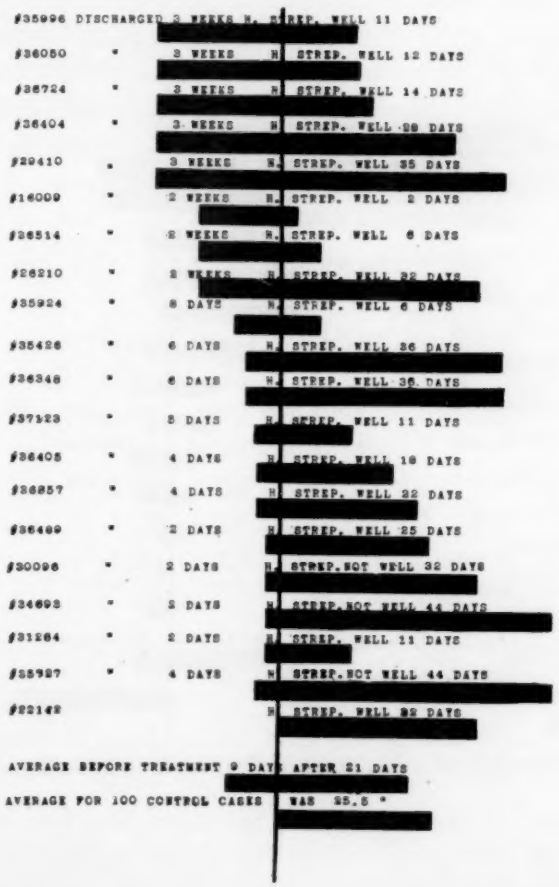
#35996 DISCHARGED 3 WEEKS H. STREP. WELL 11 DAYS
#36050 " 3 WEEKS H. STREP. WELL 12 DAYS
#36724 " 3 WEEKS H. STREP. WELL 14 DAYS
#36404 " 3 WEEKS H. STREP. WELL 29 DAYS
#29410 " 3 WEEKS H. STREP. WELL 35 DAYS
#16009 " 2 WEEKS H. STREP. WELL 2 DAYS
#36514 " 2 WEEKS H. STREP. WELL 6 DAYS
#26210 " 2 WEEKS H. STREP. WELL 32 DAYS
#35924 " 6 DAYS H. STREP. WELL 6 DAYS
#35426 " 6 DAYS H. STREP. WELL 26 DAYS
#36348 " 6 DAYS H. STREP. WELL 36 DAYS
#37523 " 5 DAYS H. STREP. WELL 11 DAYS
#36405 " 4 DAYS H. STREP. WELL 16 DAYS
#36857 " 4 DAYS H. STREP. WELL 22 DAYS
#36469 " 2 DAYS H. STREP. WELL 25 DAYS
#30096 " 2 DAYS H. STREP. NOT WELL 32 DAYS
#34693 " 2 DAYS H. STREP. NOT WELL 44 DAYS
#31264 " 2 DAYS H. STREP. WELL 11 DAYS
#35727 " 4 DAYS H. STREP. NOT WELL 44 DAYS
#22142 H. STREP. WELL 32 DAYS
AVERAGE BEFORE TREATMENT 9 DAYS AFTER 21 DAYS
AVERAGE FOR 100 CONTROL CASES WAS 25.5 *

Chart 2.—The results in twenty cases of otitis media in which streptococci were found.

members of the surgical staff, acetic acid was tried on a patient with a combined infection of hemolytic streptococcus and pyocyaneus. The result was remarkable. In four days the bacilli were all gone, and it was possible to get a pure culture of hemolytic streptococci from the discharge. It was found that acetic acid could be combined with the

sodium solution. Enough glacial acetic acid was added to the 0.5 per cent. sodium solution to make a 2 per cent. solution of acetic acid. This solution was just as efficient in killing bacteria of the colon group as the sodium solution alone, and it killed pyocyaneus in higher dilutions than acetic acid. This mixture caused the patients no discomfort.

NEUTRAL ACRIFLAVINE AND GENTIAN VIOLET

The clinical results in cases of otitis caused by streptococci (Chart 2) were not so striking as those obtained in cases caused by staphylococci (Chart 3). Test tube experiments (Table 5) show that neutral acriflavine kills streptococci in considerably higher dilutions than does

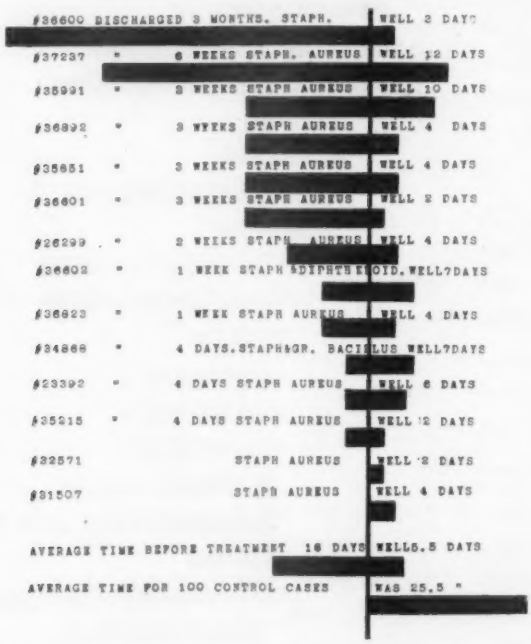
#36600 DISCHARGED 3 MONTHS. STAPH. WELL 2 DAYS
#37237 " 6 WEEKS STAPH. AUREUS WELL 12 DAYS
#38991 " 3 WEEKS STAPH AUREUS WELL 10 DAYS
#36892 " 3 WEEKS STAPH AUREUS WELL 4 DAYS
#35651 " 3 WEEKS STAPH AUREUS WELL 4 DAYS
#36601 " 3 WEEKS STAPH AUREUS WELL 2 DAYS
#26299 " 2 WEEKS STAPH. AUREUS WELL 4 DAYS
#36602 " 1 WEEK STAPH &DIPHTHEROID. WELL7DAYS
#36623 " 1 WEEK STAPH AUREUS WELL 4 DAYS
#34868 " 4 DAYS.STAPH&GR. BACILLUS WELL7DAYS
#23392 " 4 DAYS STAPH AUREUS WELL 6 DAYS
#35215 " 4 DAYS STAPH AUREUS WELL 12 DAYS
#32571 STAPH AUREUS WELL 12 DAYS
#31507 STAPH AUREUS WELL 4 DAYS
AVERAGE TIME BEFORE TREATMENT 16 DAYS WELL5.5 DAYS
AVERAGE TIME FOR 100 CONTROL CASES WAS 25.5 "

Chart 3.—The clinical results in cases of otitis media caused by staphylococci.

gentian violet. Churchman (1923) has shown that neutral acriflavine may be mixed with gentian violet, and that the mixture is more active on pyocyaneus than either drug alone. Certainly the mixture is more bactericidal for streptococci than is gentian violet. In a small series of streptococcus cases a mixture was used which was composed of 1 part gentian violet, 1 part neutral acriflavine, 10 parts of 95 per cent. alcohol, and 88 parts of distilled water. This mixture was somewhat better than gentian violet. It should be emphasized, however, that neither neutral acriflavine or the acriflavine-gentian violet mixture gave entirely satisfactory results in cases of otitis associated with streptococci.

CHRONIC OTITIS MEDIA

The cases in this series may be arbitrarily divided into a chronic and an acute group. In the chronic group were placed those patients who showed little or no fever, no leukocytosis, and no marked subjective symptoms; but whose ears were discharging more or less freely. Most of these children had suffered from the disease for weeks or months.

#30858 BOTH EARS DISCHARGING FOR 4 YEARS. MIXED GR.+AND GR.-ORGANISMS. WELL 20 DAY
#27100 ONE EAR DISCHARGING FOR 8YEARS. VINCENTS ORGANISMS IMPROVED
#22611 BOTH EARS DISCHARGING FOR 1 YEAR. MIXED GR.+AND GR.-ORGANISMS WELL 8DAYS
#22689 BOTH EARS DISCHARGING FOR 8 MONTHS. MIXED GR.+AND GR.-ORGANISMS WELL 4DAYS
#26665 BOTH EARS DISCHARGING FOR 6 MONTHS. MIXED GR.+AND GR-ORGANISMS WELL 4DAYS
#36600DISCHARGED 2 MONTHS. STAPH. AUREUS WELL 3DAYS
#21595 DISCHARGED 2 MONTHS. MIXED GR.+AND GR.-ORGANISMS WELL 5DAYS
#28889 DISCHARGED 6 WEEKS. STAPH. AUREUS WELL 28DAYS
#31944 DISCHARGED 6 WEEKS. MIXED GR.+AND GR.-ORGANISMS. WELL 10DAYS
#23237 DISCHARGED 1 MONTH MIXED GR.+AND GR. - ORGANISMS WELL 8DAYS
#35426 DISCHARGED 1 MONTH. MIXEDGR.+ORGANISMS. WELL 10DAYS
#32187 DISCHARGED 1 MONTH. MIXED GR.+ORGANISMS. WELL 12 DAYS
#35214 DISCHARGED 3 WEEKS. B. LACTUS AEROGENES WELL 21 DAYS
#36693 DISCHARGED 3 WEEKS. STAPH. AUREUS WELL 4 DAYS
#35991 DISCHARGED 3 WEEKS STAPH. AUREUS WELL 10 DAYS
#36966 DISCHARGED 3 WEEKS HEMOLYTIC STREPTOCOCCUS WELL 11 DAYS
#35520 DISCHARGED 3 WEEKS MIXED GR.+AND GR.- ORGANISMS WELL 8 DAYS
#35851 DISCHARGED 3 WEEKS STAPH. AUREUS. WELL 4 DAYS
#36601 DISCHARGED 3 WEEKS STAPH. AUREUS WELL 12DAYS
#33010 DISCHARGED 2 WEEKS MIXED GR.+AND GR.-ORGANISMS WELL 6 DAYS
#36299DISCHARGED 2 WEEKS STAPH AUREUS. WELL 4 DAYS
AVERAGE TIME OF DISCHARGE BEFORE TREATMENT 94 DAYS AFTER 7 DAY
AVERAGE TIME OF DISCHARGE OF 100 CONTROL CASES WAS 25.5 *

Chart 4.—The results obtained by treatment with synthetic drugs in twenty-one cases of chronic otitis media.

The discharge from many of the ears had the foul, repugnant odor associated with bacteria of the colon group. It was with these chronic cases that the most convincing evidence was obtained of the efficiency of local chemotherapy. The drums were opened wide, if they did not already contain a large opening, and the whole canal thoroughly cleansed with the peroxid solution. Then alternate treatments with a solution of 0.5 per cent. sodium hydroxy-mercuri-benzophenone sulphonate and 2

per cent. gentian violet were begun. When the sodium solution was used alone, after a few irrigations, examination with the direct otoscope revealed a definite redness of the drum and the proximal portion of the canal wall. The discharge, which had contained masses of bacteria and very few cells, now contained fewer bacteria and many new pus cells. In addition to killing these bacteria, the sodium solution acted as a mild counter-irritant bringing an increased blood supply to the ear and promoting healing. This mild irritation probably accounts for the rapid healing of some wounds in the ear drums, which had remained open for weeks before this treatment was started.

Some cases were readily controlled with the sodium solution alone, but the majority required the alternate treatment with gentian violet and sodium hydroxy-mercuri-benzophenone sulphonate. Chart 4 shows the results obtained in twenty-one chronic cases. In only two of the twenty patients cured, the otitis recurred but yielded readily to further treatment.

ACUTE OTITIS MEDIA

The results in the acute cases were much better than in the controls, although not so striking as those obtained in the chronic group. The average time of discharge for sixty acute cases was thirteen days as compared with an average of twenty-five and one-half days for the controls. Table 7 shows in detail the comparative efficiency of the two methods of treatment.

TABLE 7.—*Acute and Chronic Group Compared with Controls*

Group	Number of Patients	Lost		Died		Mastoid Operation		Days Required to Cure	Cured	
		Number	Per Cent.	Number	Per Cent.	Number	Per Cent.		Number	Per Cent.
Chronic	21	1	5	0	0	0	0	7	20	95
Acute	67	7	10	0	0	0	0	13	60	90
Total	88	8	9	0	0	0	0	10.6	80	91
Controls	100	14	14	8	8	4	4	25.5	78	78

Streptococci were found in more than 50 per cent. of all the acute cases of otitis media. It has been pointed out that neither gentian violet or neutral acriflavine is very effective in the treatment of otitis associated with this organism. Chart 2 shows the results in twenty cases of otitis in which streptococci were found. It is to be noted that the symptoms lasted for an average of twenty-one days each, which is only slightly shorter than in the 100 controls (twenty-five and one-half days). However, in many of these streptococcus cases the clinical improvement was immediate and striking. After two or three days treatment, the temperature was reduced, the restlessness at night diminished and the appetite improved.

COMMENT

This study shows that certain drugs exert a marked bactericidal and bacteriostatic action on some bacteria and not on others. This confirms the principle of selective bacteriostasis which has been utilized in the treatment of infected joints (Churchman, 1918[8]); empyema (Waters, 1921,[9] Davis, 1923[10]); open wounds (Churchman, 1920[8]); skin infections (Burky and Smith, 1924[11]) and staphylococcus septicemia (Smith and Casparis, 1923,[12] Young and Hill, 1924[13]). The problem in otitis media is very complicated because of the large variety of organisms involved. Yet, by alternate treatments with acetic and the sodium solution and gentian violet it was possible to eliminate all ordinary bacteria and to bring about a cure of the disease.

The new method has advantages over that of bichlorid irrigations. It is easier to apply, its effect is more rapid and it cures in a larger percentage of the cases. It does not predispose to mastoiditis. This complication was not found a single time in eighty-eight consecutive cases treated with local chemotherapy although 4 per cent. of the controls required mastoid operations.

CONCLUSIONS

1. Practically all the gram-negative bacteria found in the ears of patients suffering from otitis media, except pyocyaneus bacilli, are killed by an 0.5 per cent. solution of sodium hydroxy-mercuri-benzophenone sulphonate.

2. Pyocaneus bacilli are readily eliminated by treatment with 2 per cent. acetic acid, or preferably with 0.5 per cent. of the sodium solution which contains 2 per cent. acetic acid.

3. All the gram-positive bacteria found in otitis media are readily killed by gentian violet except streptococci.

4. Neutral acriflavine has been proved more potent in the treatment of otitis media associated with streptococci, but even this drug is not entirely satisfactory.

5. Twenty cases of chronic otitis media were cured by local chemotherapy in an average of seven days each.

6. Sixty cases of acute otitis media were cured in an average of thirteen days each.

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13. Young, H. H., and Hill, J. H.: The Treatment of Septicemia and Local Infections by Intravenous Injections of Mercurochrome-220 Soluble and of Gentian Violet, J. A. M. A. **82**:669 (March 1) 1924.

THE EFFECT OF FASTING ON THE METABOLISM OF EPILEPTIC CHILDREN *

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AND
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Last winter, on the Children's Medical Service of the Massachusetts General Hospital, we had the opportunity of studying a few patients with epilepsy that were undergoing, as a therapeutic measure, prolonged periods of fasting.

Since for some time it has been generally conceded that this method of treatment has met with considerable success in decreasing the number and severity of the epileptic seizures, we were interested in ascertaining, if possible, what metabolic changes occurred, coincident with improvement, that might reasonably serve as a basis for explaining the effect or influence of fasting on this disease.

Our attention was directed principally toward the study of changes in the blood and urine. These observations included determinations of the certain chemical constituents both before, during and following fasting.

The substance of this report will be presented under the three general phases into which the investigation resolved itself: (1) alterations of the various blood components; (2) analogous studies of the urine chemistry, and (3) the effect of shifts in the alkali reserve on the hydrogen-ion concentration of the blood.

When this research was commenced, there were no detailed chemical reports in the literature which applied to the problem as outlined. Recently, publications from other clinics [1] have shown that similar studies were being carried on simultaneously with those reported here.

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* Received for publication, April 23, 1924.

* From the Children's Medical Department, Massachusetts General Hospital, under the direction of Prof. Fritz B. Talbot.

* This paper is No. 25 of a series of studies in metabolism from the Harvard Medical School and allied hospitals. The expenses of this investigation have been defrayed (in part) by a grant from the Proctor Fund of the Harvard Medical School for the Study of Chronic Diseases.

1. Lennox, W. G.: Increase of Uric Acid in the Blood During Prolonged Starvation, J. A. M. A. **82**:602 (Feb. 23) 1924. Lennox, O'Connor, and Wright: Studies of the Metabolism in Epilepsy. I. The Nonprotein Nitrogenous Constituents of the Blood, Arch. Neurology and Psychiatry, **11**:54 No. 1 (Jan.) 1924. Gamble, Ross and Tisdale: The Metabolism of Fixed Base During Fasting, J. Biol. Chem. **57**:633, 1923.

However, since some of our findings have not been covered in these articles, we are presenting without much comment the complete protocols of our work.

Two cases were studied in this investigation. One of these patients underwent two fasts and the other patient one. Their histories and clinical studies are briefly as follows.

REPORT OF CASES

CASE 1.—J. B., a girl, aged 9 years, whose family history was negative, commenced to have attacks of petit mal at the age of 5½ years. The attacks persisted and increased in number and severity up to the time of her entrance to the hospital, at which time she was having from eighteen to twenty-five attacks daily. No grand mal symptoms had ever been noted. The attacks consisted of sudden fibrillary twitchings of the eyes and lids, immediately followed by rolling upward and to the right. The head turned in the same direction and the chin was elevated. During the attacks the patient would be unconscious and would fall if unsupported, and many times there was loss of sphincter control. The average attack lasted only twenty or more seconds. Immediately afterward she would continue her conversation, or play as if nothing had happened, but she was always aware of having had one of her spells. During the three year period following the onset of the seizures the patient was continually under observation in other cities, but the various therapeutic measures, including operation for adhesions in the region of the duodenum, were unsuccessful.

CASE 2.—W. P., a boy, aged 11 years, of Jewish parentage, whose family history was negative. There are five other children living and well. The patient had been treated in this hospital at different times since the age of 9 months. He was first seen in the outpatient department when 9 months of age, at which time the diagnosis of umbilical hernia and cervical adenitis was made. At 10 months he had pneumonia; at 18 months whooping cough. In January, 1915, when 2½ years old, he was admitted to the ward on account of convulsions and fever. The diagnosis of otitis media was made, and on opening of the ears the convulsions disappeared. During the next five years the patient made several visits to the outpatient department for ailments such as indigestion, colds, chickenpox, mumps and measles, during which time there were no convulsions.

The present trouble began about five months before the time the patient was admitted to the hospital for study. The first convulsion occurred suddenly one evening, a few hours after the boy had gone to bed. It lasted over one hour, during which time there was unconsciousness and generalized clonic muscle spasm. During the succeeding five months he had five or six such attacks. Besides these major convulsions the patient stated that, following the first, he had had numerous attacks that were characterized by numbness and loss of power of the right arm and leg. He seldom fell, as he generally knew when these attacks were coming on and had time to sit down. There have been on an average from four to six of these slight attacks each week. Their duration was from one-half to one minute.

On entrance to the hospital both patients went through a preliminary period of thorough study. The customary examinations of the eyes, teeth, and roentgenograms of the head and gastro-intestinal canal were made, to rule out all possible reflex causes of convulsions. These were all found to be normal. The regular physical examinations were negative. The diagnoses of epilepsy were confirmed by a neurologist.

In each case the children were kept in bed and put on a standard diet. Under these uniform conditions of diet, environment and activity, preliminary control chemical observations were made. The urine was collected quantitatively. After a control period of three days the fast was commenced.

During the entire fast the patients were kept in bed and given nothing but water, the fluid intake varying between 65 and 100 ounces (1,922 and 2,960 c.c.).

Daily observations were made on the blood pressure, breath acetone, weight, the number of attacks, and the temperature, pulse and respiration. A low soapsuds enema was given every morning and a high irrigation with physiologic sodium chlorid solution was given every evening. Care was taken, especially during the latter part of the fast, to keep the patients warm. Special attention was given to amusing and keeping them busy. Assistance in this was given by Miss Isabel Whittier, the occupational therapist of the ward.

TABLE 1.—*Measurement of Blood Constituents from Case 1 Before, During and After the First Fast of Nine Days*

		Fasting					
	Before	2d Day	3d Day	6th Day	9th Day	After	
Sugar, mg. per 100 c.c.	100	....	51	48	52	54	80
Uric acid, mg. per 100 c.c.	3.72	6.04	7.28	8.00	7.76	3.20	3.36
Nonprotein nitrogen, mg. per 100 c.c.	33.30	....	36.9	26.9	31.8	27.9	24.3
Bicarbonate,* percentage by volume	54.30	....	32.6	....	40.0	64.3	60.8
*p*H	7.368	....	7.28	....	7.37	7.37	

* Carbon dioxid combining power of the plasma.

TABLE 2.—*Measurements of Blood Constituents from Case 1 Before, During and After the Second Fast of Six Days*

		Fasting						
	Before	1st Day	2d Day	3d Day	4th Day	5th Day	6th Day	After
Sugar, mg. per 100 c.c.	94	94	53	49	46	50	49	95
Uric acid, mg. per 100 c.c.	5.72	4.88	7.40	11.76	12.00	12.28	9.24	5.36
Amino acid, mg. per 100 c.c.	6.51	6.23	....	5.04	5.11	.....	5.67	7.91
Nonprotein nitrogen, mg. per 100 c.c.	30.90	25.1	....	34.50	34.20	34.80	37.80	39.90
Creatinin, mg. per 100 c.c.	1.20	1.21	....	1.29	1.56	1.65	1.30	1.20
Bicarbonate,* percentage by volume	55.00	51.70	29.40	29.50	25.40	25.10	32.30	65.00
*p*H	7.37	7.31	7.18	7.22	7.12	7.13	7.28	7.36

* Carbon dioxid combining power of the plasma.

TABLE 3.—*Measurements of Blood Constituents from Case 2 Before, During and After Fast of Eight Days*

		Fasting								
	Before	1st Day	2d Day	3d Day	4th Day	5th Day	6th Day	7th Day	8th Day	After
Sugar, mg. per 100 c.c.	75	88	57	54	46	45	57	58	59	85
Uric acid, mg. per 100 c.c.	5.55	4.24	6.36	4.32	6.20	7.52	8.00	6.00	8.80	3.64
Amino acid, mg. per 100 c.c.	6.79	5.46	5.74	6.09	6.58	6.51	6.30	6.58	6.44	6.79
Nonprotein nitrogen, mg. per 100 c.c.	....	39.80	....	29.40	....	38.70	30.00	25.50	33.00	34.10
Creatinin, mg. per 100 c.c.	....	1.62	....	....	....	1.51	....	....	....	1.26
Bicarbonate,* percentage by volume	....	54.10	46.50	39.50	33.80	....	....	32.60	43.40	60.40
*p*H	.. .	7.47	7.39	7.36	7.30	....	....	7.23	7.37	7.44

* Carbon dioxid combining power of the plasma.

The blood findings [2] are presented in Tables 1, 2 and 3.

Study of the tables show that there is strikingly little variation in the blood creatinin, nonprotein nitrogen and amino-acid when determined

2. Blood samples of the control period, as well as those on the first day of fast, were taken twelve hours after the last food.

from day to day, and that the deviation is not outside of normal limits, before, during or after fasting.

The blood uric acid before and after the fast was within the limits accepted for normal children, but during the fast there was a definite increase appearing from the second to the fourth day which was maintained at a high level until the fast ended. In Case 1, this increase

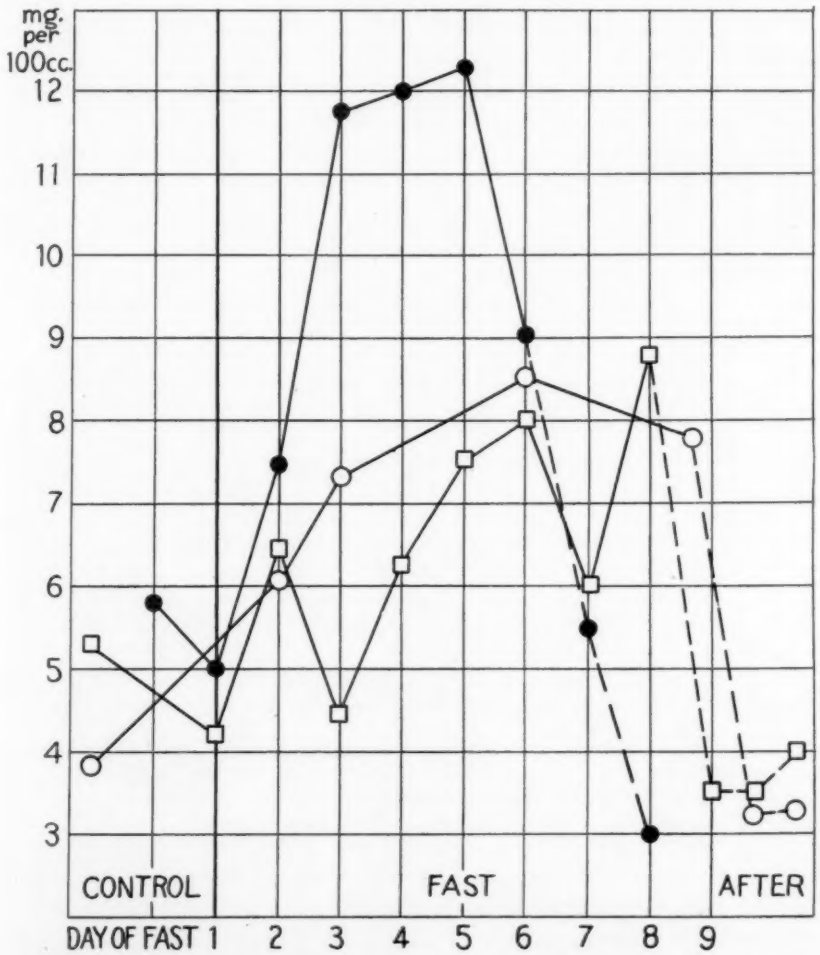

Chart 1.—The marked increase in blood uric acid concentration in each of the three fasting periods. White dots, first fast, and black dots second fast in Case 1. Square, fast in Case 2. Broken line, post-fasting periods.

amounted to over 100 per cent. during the first fasting period and above 200 per cent. during the second fast.

This marked increase of blood uric acid during fast is similar to that found by Lennox [1] in fasting normal and epileptic adults at this hospital.

The blood sugar figures before the fast was instituted were within normal limits. During the fast, there was a marked decrease in the amount of blood sugar which was evident on the second day and reached the low point by the fourth or fifth day. The lowest figure obtained was 45 mg. per hundred cubic centimeters of blood.[3] That there was a striking uniformity in the trend of the blood sugar levels during these three periods of fast is shown in Chart 2.

Blood sugar findings in adult fasting normal persons or epileptic patients have not been found to fall below the lower limit of the normal range. So far as we know the decrease in the blood sugar found in these children is a new observation. There is no explanation of the difference between the adult and the child in this regard. The extremely

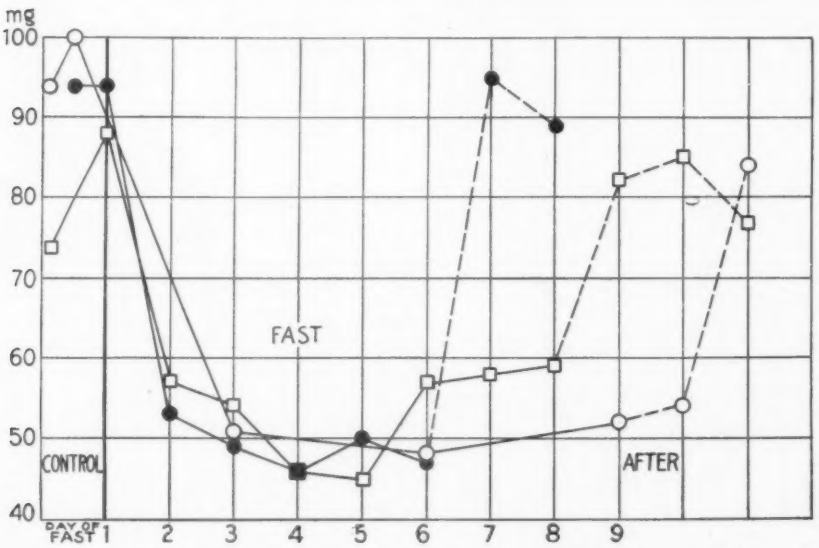

Chart 2.—The striking decrease in blood sugar concentration, and its maintenance at a low level throughout the entire fasting periods. White dots, first fast, and black dots second fast in Case 1. Square, fast in Case 2. Broken line, post-fasting periods.

low blood sugar findings, falling below 50 mg., must be emphasized. Joslin [4] calls attention to the fact that death usually occurs in diabetic patients with undernutrition when their blood sugar approaches 40 mg. and comments on one case as unusual, because of the patient's recovery after the blood sugar had fallen to 50 mg. The consistently low figures reported here have not been found in adults or children except in

3. The Folin-Wu method for blood sugar determination was used. In order to prevent the possibility of error through glycolysis, the blood was precipitated within one-half hour after it was drawn.

4. Joslin, P.: Diabetic Metabolism with High and Low Diets. Publication No. 323 Carnegie Institution of Washington, 1923.

instances of hypoglycemia induced by the administration of insulin. Cases of the latter type have been encountered not infrequently since the use of insulin, but in almost every instance the hypoglycemia is accompanied by definite clinical manifestations of an alarming and some-

TABLE 4.—*Urinary Findings in Case 1 During the First Fast*

Date, 1923	Day of Fast	Volume, C.c.	p_H	Titratable Acidity, C.c. N/10	Ammonia, C.c. N/10	Total Nitrogen Gm.	Uric Acid, Mg.
April 24-25	...	1,050	6.26	136.5	185.3	5.30	493
April 28-29	1	1,640	....	.....	.....	5.08	208
April 30-} May 1 }	3	1,740	5.14	401.1	382.9	4.29	311
May 1- 2	4	1,430	5.20	437.6	352.9	6.69	122
May 2- 3	5	2,040	7.81*	.....	882.3*	9.50	306
May 3- 4	6	1,795	5.72	256.0	611.1	3.64	413
May 4- 5	7	1,260	6.84	94.5	481.1	5.78	252
May 5- 6	8	1,500	5.84	152.3	594.1	6.45	315
May 6- 7	9	1,820	5.90	131.0	519.4	5.90	564
May 7- 8	...	1,500	6.19	42.1	247.0	4.65	480
May 8- 9	...	1,220	6.19	30.2	244.1	2.81	268
May 9-10	...	1,380	6.19	58.4	381.1	....	248

* Specimen not kept chilled.

TABLE 5.—*Urinary Findings in Case 1 During Second Fast*

Date, 1923	Day of Fast	Volume, C.c.	p_H	Titratable Acidity, C.c. N/10	Ammonia, C.c. N/10	Total Nitrogen, Gm.	Uric Acid, Mg.	Creatinin, Mg.
June 20-21	0	820*	6.40	21.32	308.2	2.54	115	274
June 21-22	1	1,690	5.80	273.00	298.2	6.17	372	566
June 22-23	2	1,880	5.33	288.00	221.1	5.17	338	821
June 23-24	3	645*	5.14	374.00	176.4	5.55	90	542
June 24-25	4	1,130	5.33	535.00	2,364.7	9.72	192	509
June 25-26	5	1,230	5.14	362.00	1,088.2	5.19	308	418
June 26-27	6*	.....	....	.....	.....	....	...	...
June 27-28	...	1,640	5.80	239.00	433.5	5.17	721	705

* Incomplete specimen.

TABLE 6.—*Urinary Findings in Case 2*

Date, 1923	Day of Fast	Volume, C.c.	p_H	Titratable Acidity, C.c. N/10	Ammonia, C.c. N/10	Total Nitrogen, Gm.	Uric Acid, Mg.	Creatinin, Mg.
Aug. 4- 5	0	1,500	6.37	67.1	132.3	3.74	249	645
Aug. 5- 6	0	1,200	6.37	41.2	128.8	2.06	142	...
Aug. 6- 7	1	995	5.72	147.2	111.2	2.24	269	517
Aug. 7- 8	2	880	6.72	.....	776.5	2.41	125	386
Aug. 8- 9	3	2,300	6.00	505.7	487.0	4.82	299	207
Aug. 9-10	4	1,800	5.72	293.4	594.1	3.24	108	522
Aug. 10-11	5*	.....	....	.....	.....	....	...	...
Aug. 11-12	6	2,400	....	.....	451.7	3.72	360	627
Aug. 12-13	7	2,570	....	200.6	483.5	3 60	257	539
Aug. 13-14	8	2,270	6.19	154.1	654.1	3.48	749	545
Aug. 14-15	...	745	7.81	.....	235.9	2.91	256	...
Aug. 20-21	...	1,665	6.37	43.1	107.6	2.03	215	516

* Incomplete specimen.

times fatal nature. These epileptic children showed few, if any, of the symptoms usually associated with the hypoglycemia state; but, on the contrary, their convulsive seizures disappeared, their general appearance improved and their mental reactions were much more nearly normal at

this stage. It is interesting to note that this drop in the blood sugar level was accompanied by a marked increase in the excretion of acetone and a lowering of the alkali reserve.

Quantitative twenty-four hour collections of urine were made, and with the exception of some days (marked with asterisk) the specimens are believed to be accurate. The analyses are shown in Tables 4, 5 and 6.

During the fast there was an increase in the excretion of ammonia. The titratable acidity was increased as also was the hydrogen-ion concentration, and qualitative tests showed acetone bodies. These figures show an increased excretion of acid from the body similar to those found in other reported fasts. The increase in ammonia and in the titratable acidity is understandable on the basis of the existing ketosis.

Attention was directed toward the reaction of the blood, because of the association of acidosis with many of the procedures having a favorable influence on epilepsy. Symptoms ascribed to acidosis frequently accompany ether anesthesia, acute infection and various other conditions during and after which epileptic convulsions in some instances may subside. A few patients fasted in this hospital seemed to show that if carbohydrates were given, and little or no acidosis resulted, there was less improvement than when the acidosis accompanied the fast. The presence of ketosis, as evidenced from observations on the acetone body excretion in the breath and urine, together with the marked lowering of the alkali reserve of the blood during the fasting period, made it desirable to determine whether or not this ketosis caused any change in the reaction of the blood. It was felt that if in these fasting patients a measurable increase in the hydrogen-ion concentration of the blood could be shown, coincident with the amelioration or cessation in the symptoms, the rôle of acidosis in epilepsy would be more clearly understood.

Chart 2 shows in a graphic manner the observed relationships between the p_H of the blood,[5] the carbon dioxid tension of the alveolar air and the carbon dioxid combining power of the plasma in the second and most severe fast of the patient (Case 1).

The lowering of the p_H may be explained by the theory that the pulmonary ventilation, as evidenced by the carbon dioxid tension of the alveolar air, was not sufficient to compensate entirely for the marked lowering of the carbon dioxid combining power of the blood. As the

5. For obtaining the p_H of the blood we used the Hasselbalch formula. The blood p_H was computed from determinations of the carbon dioxid tension of the alveolar air and the carbon dioxid combining power of the plasma. The alveolar air figures were obtained from at least four Haldane samples which checked very closely. The plasma figures were obtained from blood drawn without stasis, and saturated at our own alveolar tension at room temperature. On one patient we made ten determinations under normal conditions and obtained very consistent checks. We are well aware that our figures on the p_H of the blood are only relative and not the absolute values.

hydrogen-ion concentration of the blood is an expression of the ratio $H_2CO_3/BHCO_3$ it follows that when either factor is varied out of proportion to the other, the ratio is no longer constant. Since in this instance the dissolved carbon dioxid (estimated from the alveolar carbon dioxid tension) failed to decrease to as great an extent as the combined carbon dioxid, the numerator changed more than the denomi-

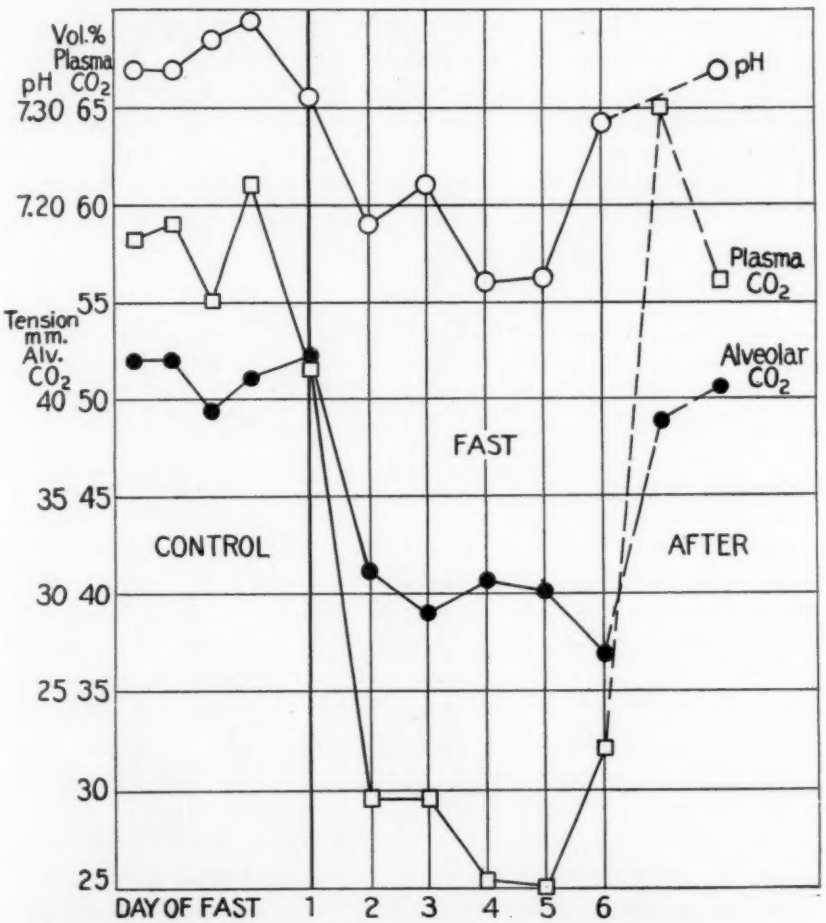

Chart 3.—The second fast of Case 1. Broken line indicates the post-fasting period.

nator and the normal ratio was changed giving an acidosis. The conclusion may be drawn that blood neutrality was not maintained, due to a failure on the part of the respiratory system to fully compensate for the lowered base.

Clinically, the convulsive symptoms disappeared shortly after the point of greatest acidosis was reached. There was a consistent improve-

ment physically and mentally, and a complete temporary disappearance of the symptoms. In Case 1, the patient was free from attacks for four weeks after the first fast, the attacks then returned coincident with an acute infection but were milder and less frequent than before the first fast. After the second fast she was free from attacks for a few days, but the number, length and severity of the attacks were greatly diminished for several months. At no time were they as severe as they were before fasting was instituted. In Case 2 the boy received little or no immediate benefit from the fast, but the severity and frequency of attacks diminished. This slight improvement persisted for three months. In both patients the mental improvement and that in the general condition was greater than appears in the record of attacks. Further studies in fasting are being carried out in this laboratory to throw more light on these findings. They will appear in subsequent publications, forming a part of a series of investigations on epilepsy.

SUMMARY

Studies of three fasting periods on two cases of epilepsy are reported. It is shown that in these epileptic children fasting is accompanied by:

1. A marked reduction of the alkali reserve and a measurable increase in the hydrogen-ion concentration of the blood.

2. An increased excretion of ammonia and of the titratable acidity of the urine.

3. A striking increase in the uric acid content of the blood.

4. A decrease in the concentration of the sugar in the blood, which returns to normal after the fast is ended.

5. A distinct but temporary amelioration of epileptic symptoms.

THE ELECTROCARDIOGRAM IN CRETINISM AND IN MONGOLIAN IDIOCY *

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It has been supposed for some time that the T-wave in the electrocardiogram is high in hyperthyroidism and low, absent or even inverted in hypothyroidism. White and Aub [1] made a study of a series of twenty-seven cases of thyroid disease in adult patients in this hospital, to determine if there was any parallelism between the basal metabolism and the amplitude of the electrocardiographic T-wave. They found a very limited parallelism, practically none in hyperthyroid cases, but a considerable degree in hypothyroid cases. It was observed that the administration of thyroid in cases of hypothyroidism caused the T-wave to increase under treatment. Zondek [2] reported observations on the heart in myxedema, in 1918 and 1919, in which he found that the heart, shown by roentgenogram, was enlarged, that the pulse action was weak with a slow rate, and that the blood pressure was normal. In the electrocardiogram he found both the P-wave and the T-wave absent. After treatment by thyroid, the heart returned to normal size except for the aorta which remained widened, the pulse rate increased, the blood pressure remained constant, and the P-wave and the T-wave appeared in the electrocardiogram.

In addition to the effect of hypothyroidism, a lowering of the T-wave is the usual result of the administration of digitalis, as shown by Cohn [3] and White and Sattler.[4] It is also often low in myocardial weakness. Seham [5] found that the T-wave is absent or very low in the new-born during the first ten days of life.

During the last year at the Massachusetts General Hospital electrocardiograms were taken on eight cretins and twelve mongolian idiots before they had received any treatment. The age of these patients varied from 6 weeks to 10 years.

In the electrocardiograms of the eight cretins the pulse rate varied from 80 to 110, except in an infant aged 6 months who had a rate of

* Received for publication, April 24, 1924.

* From the Children's Medical Service, Massachusetts General Hospital.

1. White, P. D., and Aub, J. C.: The Electrocardiogram in Thyroid Disease, Arch. Int. Med. **22**:766 (Dec.) 1918.

2. Zondek, H.: München. med. Wchnschr. **65**:1180, 1918.

3. Cohn, A. E.; Fraser, F. R., and Jamieson, R. A.: J. Exper. Med. **21**:593, 1915.

4. White, P. D., and Sattler, R. R.: J. Exper. Med. **23**:613 (May) 1916.

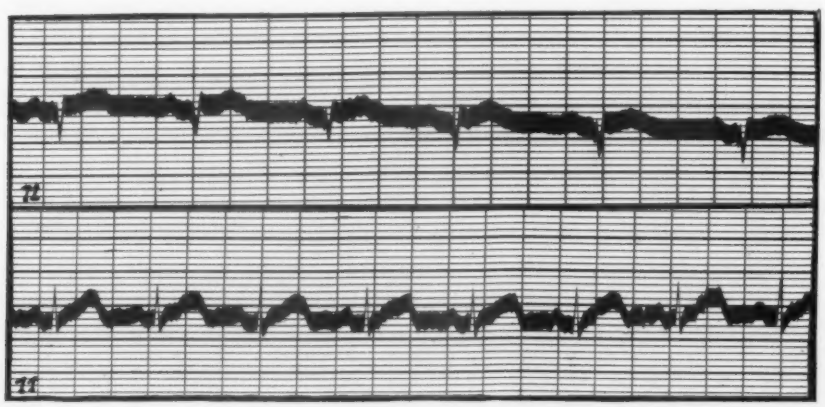
5. Seham, Max: The Electrocardiogram in Normal Children, Am. J. Dis. Child. **21**:247 (March) 1921.

150 (crying). There was little change from the normal electrocardiogram in these patients except in the T-wave which in every instance in Lead 11 was below the normal height: one being slightly inverted, one flat, four of + 1 mm. and two + 1.5 mm. The normal T-wave in Lead 11 is between 3 and 5 mm.

Changes in Electrocardiogram and Basal Metabolism of Three Cretins After the Administration of Thyroid Extract

Name	Age	Treatment	Electrocardiogram	Date	Metabolism, per Cent.	Date
F. S.	11 mo.	Feb. 26 to April 4, 1923, 1-3 grains thyroid daily; April 4 to October, 1923, 2 grains daily	Normal rhythm Rate 95 T_2 + 1 mm.	2/ 7/23	—42	2/ 7/23
			Normal rhythm Rate 125 T_2 + 6 mm.	4/ 4/23	—12	3/14/23
			Normal rhythm Rate 110 T_2 + 3 mm.	10/10/23	Normal	11/ 8/23
V. M.	6 mo.	Oct. 16, 1923, ¼ grain thyroid daily; Oct. 26, 1923, 1 grain thyroid daily to March 19, 1924	Rate 150 T_2 slightly inverted	10/10/23	—33	10/15/23
			Rate 120 T_2 same	10/28/23	—19	10/26/23
			Rate 140 T_2 + 2.5 mm.	3/19/24	Not done	
L. B.	10 yr.	July 30, 1923, 6 grains thyroid daily started	Rate 80 T_2 + 1 mm.	7/26/23	—13	7/27/23
			Rate 100 T_2 + 3 mm.	8/15/23	Normal	8/13/23

Metabolism given in + or — percentage variation from normal.



Upper curve: electrocardiogram (Lead II) of L. B., July 26, 1923, before treatment. Lower curve: electrocardiogram (Lead II) of L. B., August 15, after two weeks' treatment with 6 grains of thyroid daily, showing effect of thyroid on the T wave.

In the twelve patients with mongolism the pulse rate varied from 90 to 160, and the T-wave was + 5 mm. in four instances, + 3 in five and + 1.5 mm. in three.

In three patients with cretinism thyroid was given and subsequent electrocardiograms were taken; in two of them basal metabolic rates were determined before and after treatment. Besides the increase in

the height of the T-wave following thyroid administration, there is often an increase in the amplitude of the Q-R-S complex, as shown in the figure.

Eight of the mongolian idiots had their metabolism determined before treatment, the results varying from — 24 per cent. to + 22 per cent. In one of the patients where the T-wave was only 1.5 mm. high, after the administration of pituitary extract, 2 grains daily, and suprarenal cortex, 3 grains daily; over a period of two months, the T-wave was increased to + 3 mm. The other two patients with T-waves of + 1.5 mm. were not treated.

CONCLUSIONS

From these cases it appears that in pure cretinism as in myxedema the T-wave in the electrocardiogram is lowered, flattened or even inverted, and can be brought up to normal by the administration of thyroid. In mongolian idiocy there is no characteristic change in the electrocardiogram.

THE KETOGENIC DIET IN THE TREATMENT OF EPILEPSY*

A PRELIMINARY REPORT

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A brief review of the last eighty-six cases of epilepsy seen in the Section on Pediatrics is presented for the purpose of comparing the results of various forms of treatment, and to present a new dietary regimen, the ketogenic diet.

Forty-six of the patients were males, and forty were females. The youngest patient was 1 year of age, the oldest 15 (the arbitrary age limit for patients in the Section on Pediatrics). The average age of the patients was eight and fifty-one hundredths years. The average duration of symptoms, as noted by the parents, was three and three-tenths years.

Thirty patients had had previous treatment; in twenty-three of these the results of the treatment were fair, that is, there was a decrease in the number and in the severity of the attacks. The condition of twenty-two of the patients was diagnosed petit mal; of forty-one, grand mal, and of twenty-three, grand and petit mal. Forty-three patients had a history of hereditary taint or familial disease. Twenty had a definite family history of sick headache (migraine), nine of epilepsy, and fourteen of insanity, nervousness and so forth. In nineteen cases there was a history of difficult labor, and in twelve of these, delivery had been by instrument. Eight patients had had infantile convulsions; four, severe injury, and ten especially severe acute infections. In sixty-eight cases, the disease had been definitely progressive, the attacks increasing in number and severity; in two, the number and severity of attacks had decreased, and in sixteen the disease was considered stationary.

The only important point in the physical examination of these patients was the demonstration of foci of infection, such as dental caries, infected tonsils and adenoids, and in two patients, of defects in the skull. Thirty-eight patients had definite foci of infection. The Wassermann blood test was negative in all of the eighty-six patients. The roentgen-ray examination of the skull was negative in seventy-eight patients. In three there were areas of bone defect, old fractures; and in three there was reported evidence of slight increase in intracranial pressure, but the patients had no other signs of increased intracranial pressure. The fundus was essentially normal in the entire series.

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* Received for publication, May 8, 1924.

* From the Section on Pediatrics, Mayo Clinic.

THE KETOGENIC DIET

Three years ago, Wilder [1] proposed the use of ketogenic diets in the treatment of epilepsy. His interest in the subject was aroused by the favorable results of prolonged fasting reported by Geyelin.[2] One of the metabolic irregularities accompanying fasting is the accumulation and excretion of aceto-acetic acid and its products, beta-hydroxybutyric acid and acetone. A similar ketosis occurs in diabetes when the oxidation of sugar is sufficiently depressed, and may be provoked in nondiabetic subjects by diets in which the proportion of carbohydrate and protein are sufficiently restricted. Wilder suggested that such diets might offer a method of treatment for epilepsy which would equal or surpass in effectiveness the fasting procedure, and prove to be more practical because it could be continued for longer periods.

Certain theoretical considerations helped to shape Wilder's proposal. Of the three ketone bodies, aceto-acetic acid alone has any pronounced toxic action. Its effect is not unlike that of the anesthetics. Diabetic coma, a condition in which intoxication with aceto-acetic acid is extreme, may possibly be a form of anesthesia. Anesthetics in general possess certain common physical and chemical characteristics. Chloroform, ether and ethylene are soluble both in water and fat, and possessing these properties, may presumably penetrate with ease into the lipoids of the central nervous system. Aceto-acetic acid is similarly soluble in aqueous and lipoid substances. Finally, all of the anesthetics possess chemical structures suggesting that they undergo a certain degree of dissociation into bivalent carbon or methylene-like products. Substances capable of such dissociation, for instance hydrocyanic acid, exert profoundly narcotizing effects. Aceto-acetic acid, in all probability, undergoes methylene dissociation, and this property, together with its ready entry into the lipoidal nerve cells, may be the explanation of its anesthetic action.

It is well known that a chloroform or ether anesthesia in epilepsy will often suppress epileptic attacks for a considerable period. It seems not unlikely, therefore, on theoretical grounds, that aceto-acetic acid should have a beneficial action in epilepsy.

It is not practical to attempt to accomplish a ketosis by feeding or injecting aceto-acetic acid, because the organism easily converts this substance into nontoxic materials. Wilder [3] showed, for instance, that in normal dogs, when adequate carbohydrate metabolism was under way,

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1. Wilder, R. M.: The Effect of Ketonemia on the Course of Epilepsy, Mayo Clinic Bull. **2**:307, 1921.
2. Geyelin, H. R.: Fasting as a Method for Treating Epilepsy, M. Rec. **99**:1037-1038, 1921.
3. Wilder, R. M.: Intravenous Injections of Beta-hydroxybutyric and Acetoacetic Acids, J. Biol. Chem. **31**:59-65 (Feb.) 1917.

injected aceto-acetic acid was promptly and totally converted into beta-hydroxybutyric acid. Therefore, the only practical method of securing a sufficient accumulation of aceto-acetic acid in the nondiabetic body is to restrict carbohydrate metabolism, either by starvation or by a diet containing a minimal amount of carbohydrate. The work of Zeller,[4] Ladd and Palmer,[5] Shaffer [6] and others makes it possible to plan diets that will be ketogenic, and Wilder has proposed the following scheme for the diet of epileptic patients.

Protein may be converted in large part into glucose; therefore, the protein allowance must not exceed 1 gm. for each kilogram of body weight. In adults two-thirds of a gram is adequate.

The total calories should not exceed the actual metabolic requirements of the patient. This requirement may be calculated with sufficient accuracy by taking the basal metabolism, and increasing this from 30 to 50 per cent. The basal metabolism may be determined directly, or it may be calculated from the Du Bois normal standards. Knowing the total calories of the diet and the protein allowance, the following formulas give the fat and carbohydrate:

$$F = 0.101\ M - 0.216\ P$$
$$C = 0.244\ M - 2.27\ F - P$$

In practice this amounts to feeding not more than 15 gm. of carbohydrate, and in some cases less than 10 gm. of carbohydrate daily, with not over 1 gm. of protein for each kilogram of body weight, and enough fat to make up the required calories.

These diets should not be started abruptly, or they may not be tolerated. After a few days on less rigid carbohydrate restriction, however, they can be instituted without harm, if due attention is paid to vitamins and salts in planning menus. The recent work of Frank,[7] and that of Osborne and Mendel [8] are important in this connection. Young

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4. Zeller, H.: Einfluss von Fett und Kohlenhydrat bei Eiweishunger auf die Stickstoffausscheidung, Arch. f. Physiol. 1914, pp. 213-236.

5. Ladd, W. S., and Palmer, W. W.: The Carbohydrate-Fat Ratio in Relation to the Production of Ketone Bodies in Diabetes Mellitus, Proc. Soc. Exper. Biol. & Med. **18**:109-110, 1920; The Use of Fat in Diabetes Mellitus and the Carbohydrate-Fat Ratio, Am. J. M. Sc. **166**:157-169 (Aug.) 1923.

6. Shaffer, P. A.: Antiketogenesis. I. An in Vitro Analogy, J. Biol. Chem. **47**:433-448 (July) 1921; Antiketogenesis. II. The Ketogenic Antiketogenic Balance in Man, ibid. **47**:449-473 (July) 1921; Antiketogenesis. III. Calculation of the Ketogenic Balance from the Respiratory Quotients, ibid. **49**:143-162 (Nov.) 1921; Antiketogenesis. The Ketogenic-Antiketogenic Balance in Man and Its Significance in Diabetes, ibid. **50**:26, 1922.

7. Frank, A.: Tierexperimentelle Untersuchungen über Fetternährung, Monatschr. f. Kinderh. **24**:487-493 (Jan.) 1923.

8. Osborne, T. B., and Mendel, L. B.: Nutrition and Growth on Diets Highly Deficient or Entirely Lacking in Preformed Carbohydrates, J. Biol. Chem. **59**:13-32, 1924.

rats were reared to normal maturity on diets consisting almost exclusively of fat and protein.

Twenty patients with epilepsy have been on such a ketogenic diet for not less than two months. For thirteen patients the diet was used alone, and for seven it was supplemented with phenobarbital. These were not selected, except as circumstances forced selection. Many of our patients come from long distances and are anxious to return home as soon as possible. Many are unable to stay for a thorough trial of the diet, and many parents are not competent to learn the diet and to carry it on at home. Of the thirteen patients with epilepsy treated with the ketogenic diet alone, nine have been free from further attacks for two months, two months, two months, three months, six months, eight months, nine months, nine months, and one year respectively; four of these patients had petit mal, three grand mal, and two both grand and petit mal. Two patients have had only occasional attacks, "marked improvement." One of these had petit mal, the other had both grand and petit mal. The patient with grand mal and petit mal was placed in the hospital under close supervision, April 8. On the day of admission he had two attacks of grand mal; April 9, he had two attacks of petit mal. He was entirely free from epilepsy until April 20, when he obtained a number of candy Easter eggs which he ate. That evening he had three attacks of petit mal. One patient, with grand and petit mal, has shown no improvement. A specimen of urine sent by this patient does not contain acetone bodies. One patient has not been heard from.

Four patients were placed on a ketogenic diet with phenobarbital. One of these, with grand mal, has had no further attacks. Two, with grand mal, and one with grand and petit mal, have only occasional attacks. One patient has not replied to our letters. Three patients abandoned the diet and report no change in the epilepsy.

Thus, of seventeen patients treated with a ketogenic diet, ten are entirely free from convulsions; nine of these were treated with the diet alone. Four patients have shown remarkable improvement, in that the convulsions, which occurred from two to two hundred times daily, have been reduced to one every two weeks in two instances, and from three to four a day in the other two. Two patients have not been heard from. Only one patient still on the diet has failed to respond.

For comparison, the results of other types of treatment are cited. Forty-three patients received the routine treatment for epilepsy, which consists of (1) removal of all foci of infection, (2) enforcement of a definite regimen in the daily life, including avoidance of all excitement and mental strain, rest, from ten to fourteen hours of sleep plus a nap after the noon meal, daily bowel movement, and anticonstipation diet, (3) correction of errors of refraction, and (4) phenobarbital and sodium

bromid as indicated. No distinction is made, so far as treatment is concerned, between idiopathic and symptomatic epilepsy except in definitely focal convulsions following injury. Fifteen of these patients (ten with grand mal, two with petit mal, and three with grand and petit mal) have been free from attacks for from six months to three years. Seven (three with grand mal, two with petit mal, and two with grand and petit mal) are greatly improved, and have only occasional attacks. Eleven patients have not responded to treatment. Ten were not heard from. Three patients, one with grand, one with petit mal, and one with both, responded to anticonstipation diets and purging only, with no further attacks. Six patients, five with grand mal, and one with petit mal, did not respond to this treatment. Five patients are being treated by other physicians with various results. Nine patients, on various forms of treatment, were not heard from.

ABSTRACTS OF ILLUSTRATIVE CASES

CASE 1.—A boy, aged 8 years, was brought to Clinic, July 19, 1923, because of attacks of petit mal. He had had measles, mumps, pertussis, scarlatina, pneumonia, and typhoid fever. His development had been normal. Three years before examination, petit mal attacks had developed following scarlatina; they occurred every half hour, and lasted for a few seconds.

At the time of examination, the child was having attacks every five or ten minutes. September 1, he was put on the ketogenic diet 5:1 (ketogenic molecules: antiketogenic molecules). The severity and number of attacks gradually decreased, and ceased in October. At the time of the last report, Feb. 14, 1924, there had been no recurrence.

CASE 2.—A girl, aged 11 years and 7 months, was brought to the Clinic, Feb. 15, 1924, because of attacks of petit mal. The mother was nervous and had headaches. The father had had syphilis seventeen years before, and had been treated for seven years. The child had had spells of petit mal since birth.

At the time of examination, the child was having from five to one hundred attacks a day, lasting for a few seconds. The tonsils were enlarged. February 18, a ketogenic diet 2:1 was instituted. February 19, the child had six attacks; February 20, eight attacks; February 21, eight attacks; February 25 to 28, no attacks; February 29, three attacks; March 1, two attacks; March 2 and 3, none; March 4, eight; March 5, none; March 6, three, and March 7, one. The diet was then increased to 3:1. March 10, the child had two attacks. She has had none since April 12.

CASE 3.—A girl, aged 10 years and 8 months, was brought to the Clinic, Jan. 22, 1924, because of attacks of petit mal, to which she had been subject for a year. There was a family history of sick headaches. The child's development had been normal.

At the time of examination, the child was having three attacks every twenty-four hours, lasting for from fifteen to twenty seconds. The tonsils were enlarged, and infected. January 25, a ketogenic diet 2:1 was instituted. She had one attack on January 25, 26, and 27. Then she was free from attacks until February 5, when she complained of a "sore throat," was "off diet," and had two mild attacks. February 15, she had one mild attack, and again on February 17 and February 19. She had three attacks in March, but has had none since.

CASE 4.—A boy, aged 8 years and 11 months, was brought to the Clinic Sept. 12, 1923, because of attacks of petit mal. The family history was negative, and the child's development had been normal. The attacks had begun three years before.

At the time of examination there were twelve attacks daily, each lasting for ten seconds. The child was hyperactive, and had dental caries. The vision in the right eye was 6/5, and in the left 6/60. September 14, the eyes were refracted, and the ketogenic diet 5 : 1 instituted. October 30, the child had three attacks. January 11, the diet was reduced to 3 : 1. He has had no attacks since, and the diet has been reduced to 2 : 1.

CASE 5.—A boy, aged 9 years and 6 months, was brought to the Clinic Aug. 31, 1921, because of epilepsy, grand mal, and migraine. The father had migraine. The child's development had been normal. Twenty months before, he had had convulsions, lasting from three to twenty minutes. These had occurred, one every six months.

At the time of examination, the child was having convulsions once a month, varying from one to ten at each attack. The attacks were preceded by sick headache (migraine) lasting from six to twelve hours. The child had granular pharyngitis. September 5, a starvation diet was instituted, and later a ketogenic diet. Prior to July, 1923, there were four attacks, due to dietary indiscretions. Since then there have been none.

COMMENT

This preliminary report on the use of a ketogenic diet, as proposed by Wilder, in the treatment of epilepsy is made in order that the treatment may be given a general trial. It must be remembered that the object of the diet is to produce acidosis. It is desirable at the same time to enforce a rigid daily regimen, as has been outlined.

The most favorable results have been obtained in cases of petit mal, which form of epilepsy does not respond so well to phenobarbital. This series of cases is small, and the treatment has been short. Conclusions with regard to the results of treatment of this disease should be most conservative, since so much irregularity exists in the interval between attacks, and since so little is actually known of the cause. Further investigation is in progress and will be reported.

REPORT OF A CASE OF STREPTOCOCCIC MENINGITIS TREATED WITH INJECTIONS OF GENTIAN VIOLET*

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The following case of streptococcus meningitis is reported because, so far, no report has been made in the literature of a case of meningitis treated with intraspinal injections of solutions of gentian violet. The increasing interest in gentian violet injections as inhibiting the growth of gram-positive organisms led to a trial in this case of septic meningitis. The report, although having a fatal outcome, is made because something has been learned.

REPORT OF CASE

A. A. B., a boy, white, aged 2 years, whose family and past history were inconsequential, fell, on Jan. 3, 1924, while holding a lead pencil in his hand, the point of which made a very slight abrasion in the upper left eyelid near the inner canthus. An ophthalmologist saw the child at once, and found no injury to the eyeball, and a superficial wound so slight as to cause no uneasiness, though the wound was cleansed and dressed. The eyelid became contused almost at once, closing the eye completely.

On January 7, the eye was so swollen, although the child was bright and lively, that it was deemed advisable to open the wound. This was done and neither pus nor serous discharge was found.

On January 8, the patient ate breakfast as usual, but vomited shortly afterward and bit his cheek several times. At noon, while waiting to be undressed for his nap, he fell into a sort of stupor which lasted for several minutes. Ten minutes later he had a convulsion. This was general, but it was noticeable to the mother that the right side of the face, right arm and right leg twitched more violently than any other part.

On admission to the hospital the child was semiconscious, there was some degree of strabismus, the neck was rigid and the Brudzinski, contralateral and Kernig signs were all positive. The temperature was 101, pulse 112, respiration 28. Leukocytes, 15,600. Lumbar puncture, not under great pressure, showed a clear fluid, with 700 cells. Gram-positive streptococci were present. Cultures from the fluid showed streptococcus hemolyticus. Ross-Jones and Pandy tests were positive for globulin. The colloidal gold curve was normal. The spinal fluid showed a negative Wassermann. Owing to the fact that at the first examination of the spinal fluid it was not determined definitely what was the organism, it was decided to give the child the benefit of the doubt, and 15 c.c. of antimeningoccic serum was administered intraspinally.

January 9, the child was brighter and more alert. On lumbar puncture, 15 c.c. of fluid was withdrawn, and a smear from this showed gram-positive streptococci. The eye wound was open and a drain inserted. At night of the same day, a second lumbar puncture was done; 15 c.c. of fluid was withdrawn, and 10 c.c. of gentian violet (containing 0.04 mg. of violet) was injected into the spinal canal. The urinalysis was negative.

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* From the Department of Pediatrics, University of Virginia Hospital.

January 10, the child had a very comfortable night, and was much brighter. In the morning a lumbar puncture was done, and 25 c.c. of fluid removed, and 0.04 mg. (10 c.c.) of gentian violet was injected. The cell count of spinal fluid was 2,290. A culture of the spinal fluid showed streptococci. At night a second puncture produced only 6 c.c. of fluid. The injection consisted of 0.08 mg. of gentian violet.

January 11, the patient's general condition seemed to be improved. He slept all night. The neck was somewhat stiff, but no Kernig or contralateral signs were present. A morning lumbar puncture showed no increase of pressure, the fluid was cloudy, the cell count 320, chiefly polymorphonuclears; 0.08 mg. (10 c.c.) gentian violet was injected. A night lumbar puncture of 10 c.c. of fluid was withdrawn, and 0.08 mg. (10 c.c.) gentian violet injected. The cell count was 238. The Ross-Jones sign for globulin was positive. The leukocyte count was 10,300.

January 12, the infant was rational and alert. The general condition was about the same. A lumbar puncture of 20 c.c. of fluid was removed, and 0.08 mg. (10 c.c.) of gentian violet was injected. The cell count of fluid was 365. A culture from the eye showed staphylococcus albus. Blood hemoglobin, 80 per cent., leukocyte count, 12,600. Ear drums were congested and both were opened. At the night lumbar puncture only a few drops of fluid were obtained, and 0.08 mg. gentian violet was injected. The cell count was 405. Culture of the spinal fluid was still positive for streptococcus hemolyticus.

January 13, the patient's general condition was not so good and he vomited. At the morning spinal puncture 40 c.c. of fluid was withdrawn and 0.12 mg. (15 c.c.) of gentian violet was injected. The cell count was 2,040. Culture of the spinal fluid still showed streptococcus hemolyticus. Under chloroform anesthetic, the left upper eyelid was incised and a pocket of pus was found at the posterior superior portion of the orbital cavity, between the orbital fascia and the periosteum. About 4 drams (15 c.c.) of extremely foul pus was evacuated which on culture showed streptococcus hemolyticus. Twenty milligrams of gentian violet in 300 c.c. of distilled water was injected in the left jugular vein by gravity. There was no reaction. Urine passed within one-half hour of this injection was stained with the gentian violet. Urine passed four hours after was free from color. The night lumbar puncture was omitted.

January 14, the patient's condition seemed to be improved. He was bright and entirely rational. The leukocyte count was 13,200. At spinal puncture 15 c.c. of fluid was withdrawn, and 0.08 mg. gentian violet was injected. The spinal fluid cell count was 683. Culture showed streptococcus hemolyticus. Forty milligrams of gentian violet was injected intravenously. There was no reaction. The blood culture was negative (forty-eight hours).

January 15, the child was bright and entirely rational. Spinal puncture fluid, of ground glass appearance, was obtained under much pressure. The cell count was 2,096; 0.12 mg. gentian violet was injected intraspinally. Roentgen-ray examination of the supra-orbital region showed no abscess.

January 16, the patient had a fairly good night and slept well. Forty milligrams of gentian violet was injected intravenously. There was no reaction. A lumbar puncture was done, and under much pressure, fluid was withdrawn. The cell count was 948, the culture showed streptococcus hemolyticus, and 0.12 mg. gentian violet was injected intraspinally.

January 17, the child was very bright, and the appetite good. The lumbar puncture cell count was 831, and 0.12 mg. gentian violet was injected intraspinally.

January 18, the child was bright, and the appetite good. A lumbar puncture was made. The cell count was 1,605. No bacteria were seen in the smear. An injection of 0.12 mg. of gentian violet was given intraspinally, and 20 mg. gentian violet injected intramuscularly. There were no abnormal reflexes, nor had there been for several days. The neck had also been free from stiffness.

January 19, the lumbar puncture showed a clear fluid. The cell count was 319. No intraspinal injection was given in order to see whether the injections were keeping up the cell count rather than diminishing it, but 20 mg. were given intramuscularly. The blood leukocyte count was 14,800.

During the night of January 20 the child coughed a great deal. Examination showed only a few râles, and the throat was red. A spinal puncture showed a cell count of 403, and culture still showed streptococci. No gentian violet was injected. The patient's neck was stiff but all other reflexes were negative.

January 21, the patient seemed better. Lumbar puncture showed a cell count of 1,284. The culture showed streptococci. Intraspinal injection consisted of 0.12 mg. gentian violet. (Evidently the violet in the spine did not increase the cell count but rather diminished it.) Twenty milligrams of gentian violet was given intramuscularly. Urinalysis was negative but for an occasional pus cell. The urine was practically normal throughout the course of the disease.

January 22, the patient appeared to be fairly comfortable and was taking more nourishment than usual; 0.16 mg. gentian violet was injected intraspinally; 20 mg. was injected intramuscularly.

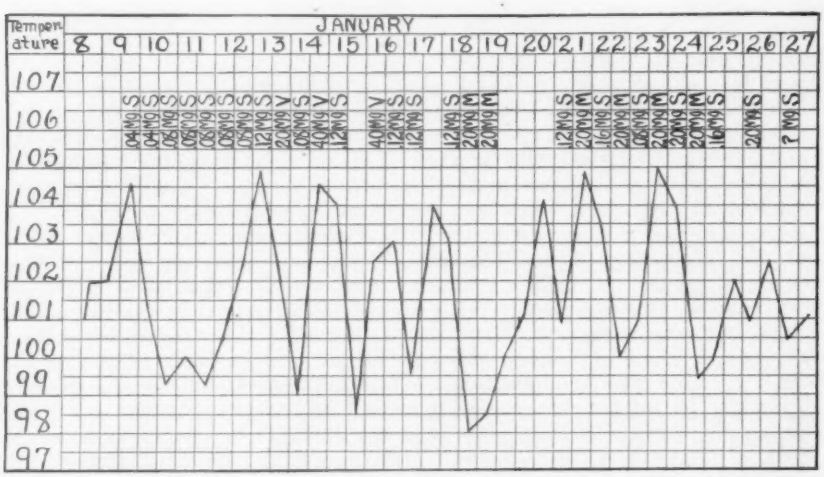

Chart showing temperature of patient, also amount of daily injections.

January 23, the patient had a restless night, his neck was stiff and a positive Kernig sign was present. The spinal puncture showed a cell count of 221; 0.08 mg. gentian violet was given intraspinally and 20 mg. intramuscularly. The leukocyte count was 18,600. The eye wound showed a large amount of discharge.

January 24, there was an urticarial rash over the entire body. The patient voided involuntarily. The leukocyte count was 27,200. The lumbar puncture showed a cell count of 1,093; 0.20 mg. of gentian violet was given intraspinally, and 20 mg. intramuscularly.

January 25, the eye wound drained a large amount of foul smelling pus during the last few days. On lumbar puncture, 48 c.c. of fluid was obtained, with a cell count of 390; the culture gave no growth; 0.16 mg. gentian violet was given intraspinally.

January 26, the patient had a more comfortable night. The general condition was not good, however, and he appeared to be in a weakened condition without any spirit. The eye wound opened extensively. A lumbar puncture showed a cell count of 270; 0.20 mg. of gentian violet was given intraspinally.

January 27, the patient was stuporous and very weak. The general state was asthenic. On lumbar puncture the cell count was 214, with no growth in culture. Gentian violet was injected intraspinally but the amount was not recorded. The patient died, January 28, at 7: 55 a. m. There was no necropsy.

CONCLUSIONS

The patient was admitted to the hospital in such a condition as to lead to the supposition that he could not live for more than a few hours. As a result of the gentian violet treatment, apparently, the child lived for three weeks. During most of this time the condition was such that one would never suspect from observation or examination that septic meningitis was present. It was felt by those observing this case that the gentian violet injections into the spinal canal gave no reaction or irritation. On the other hand, it would appear that the course of the disease was modified to a marked degree and that the cell count of the spinal fluid was influenced very decidedly. Since the blood cultures were negative, it is doubtful whether the intravenous or intramuscular injections had any effect on the course of the disease. It is probable that stronger solutions than those given would cause no irritation and might have been more efficacious.

BONE LESIONS OF CONGENITAL SYPHILIS*

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Congenital bone syphilis is fairly frequent, and its lesions, if not the most common, are among the most characteristic in the body. However, while these peculiar types of bone syphilis are more or less standard in appearance, it is extremely difficult to make a diagnosis when confronted by the many protean manifestations which this essentially polymorphic disease presents. It is the purpose of this paper to discuss some of these fairly constant diagnostic features of congenital bone syphilis and to present a few roentgenograms showing such lesions.

That bone lesions in syphiltic infants are exceptionally common cannot be disputed. Holt [1] states that in the case of a syphilitic fetus, a stillborn child or one dying soon after birth, the changes in the bones are more uniformly present than any other lesions; and Hochsinger [2] has stated that in practically every infant dying of syphilis bone lesions are found. Findlay found bone lesions present in 25 per cent. of his cases of congenital syphilis. Shipley [3] and his colleagues at Johns Hopkins Hospital, in the examination of 200 stillborn infants or infants dying soon after birth, found 25 per cent. to show radiologic evidence of bone syphilis. The lesions are essentially of the same general type but are modified to some extent by the age of the person, the location, and the duration and extent of the disease. For the purpose of description I will divide the lesions of congenital syphilis into two classes or types, those occurring early, or infantile, and those of later development, the so-called syphilis tarda.

In the infantile type, although any part of the skeleton may be affected, the long bones, particularly in or near the epiphyses seem to be a common site for the first or early lesions. The involvement may be endochondral, endosteal or periosteal and has been variously designated as osteochondritis, epiphysitis, or osteoperiostitis. Valleix,[4] in 1834, called attention to the retarded ossification and the dislocation of epiphyses seen in these cases and it has been described in detail by

* Received for publication, March 18, 1924.

1. Holt, L. E.: Disease of Infancy and Childhood, New York, D. Appleton & Co., 1911.

2. Hochsinger: Studien über hereditäre Syphilis, **2**, 1904.

3. Shipley, P. G.; Pearson, J. W.; Weech, A. A., and Green, C. H.: X-ray Picture of the Bones in the Diagnosis of Syphilis in the Fetus and in Young Infants, Bull. Johns Hopkins Hosp. **31**:75 (March) 1921.

4. Valleix: Soc. anat., 1834.

many writers, such as Ranvier,[5] Cornil,[6] Wegner,[7] Parrot,[8] Taylor,[9] Waldeyer[10] and others. Little has been added, however, since the classical description of the lesion by Wegner in 1870.

Wegner's osteochondritis, or the so-called epiphysitis, is recognized clinically by the "pseudoparalysis" of Parrot, which consists of a varying degree of flaccid paralysis in the arms, and of spastic type in the

Fig. 1.—Normal skeletal growth.

legs, which may appear quite suddenly or develop gradually. Findlay[11] states that it may be taken as an axiom that the loss of power in a limb of an infant under 6 months of age is due to syphilis. The long bones

5. Ranvier, C. R.: Soc. de biol., 1865.

6. Cornil: Leçons sur la syphilis, J. d. conn. méd. prat. **45**:155, 1878.

7. Wegner: Ueber hereditäre Knochen-Syphilis bei jungen, Kindern. Virchows Arch. f. path. Anat. **50**, 1870.

8. Parrot: Arch. de physiol. norm. et path., 1872.

9. Taylor: Syphilitic Lesions of the Osseous System in Infants and Young Children, Am. J. Obst. **53**:177, 1874; ibid, **7**:559, 1875.

10. Waldeyer and Kobner: Beiträge zur Kenntnis der hereditären Knochensyphilis, Arch. f. path. Anat. **55**:367-379, 1872.

11. Findlay: Syphilis in Childhood, London, Oxford University Press, 1919.

are affected chiefly but, according to Hochsinger,[2] Frankel,[12] and Diefenbach,[13] the lesions are not necessarily of the same degree or type. Frankel lays special emphasis on the ribs and is convinced that not only long bones, but flat bones with endochondral growth, such as the ilium (acetabulum) and the scapula are also very commonly involved. The lower end of femur, radius and ulna, with the upper end of the tibia and humerus, seem to be the most common site for

Fig. 2.—Wegner's osteochondritis. Compare with normal growth (Fig. 1).

this type of the disease. The most important changes seem to take place at the epiphyseal line and the most marked changes on the diaphyseal side. The extreme early changes result in a widening and increased density of the normally sharply cut, clear, straight edges of the diaphysis. As the disease progresses, this broad band of increased

12. Frankel: Ueber die angeborene Syphilis platter Knochen und ihre röntgenologische Erkennung, Fortschr. a. d. Geb. d. Röntgenstrahlen, **19**:300-312, 1915.

13. Diefenbach: Roentgen Ray Diagnosis of Diseases of Bone, Am. Roentgenol. **2**:178, 1910.

density, containing both bone and cartilage in irregular formation, becomes very ragged or toothed and irregular in appearance.

In the later stages, various degenerative changes may take place in the ends of the diaphyses. These degenerative changes, fully described by Wegner, may result in a rather curious "punched out" appearance of the diaphysis. The epiphyses apparently are not invloved

Fig. 3.—Wegner's osteochondritis. Note the swelling of the neck of the femora, and the marked destruction at the ends of the diaphyses.

and except in rare cases are not displaced. It is of interest to note that even in extensive lesions there is no marked deformity during the period of skeletal growth or as the result of such changes.

In the extremely early cases the periosteal lesions are not especially well marked but later they become more prominent. In some instances there is a general swelling of the bone with a periostitis, diffuse or local, which in rare cases goes on to the production of osteophitic

changes. The most common type occurs along the shafts of long bones as a smooth, light cloak about the bones (Diefenbach), as is seen in the early stage of syphilitic dactylitis. This lesion occurs most frequently under 1 year of age and is most common between the third and seventh month (Holt). It is not common and is much less so than the "spina ventosa" of tuberculosis. It more often attacks the metacarpals and metatarsals than the phalanges, although Findlay reports a case in which an infant, aged 13 months, showed involvement of all the first and second phalanges of both hands. The lesion is usually multiple and the other bones of the skeleton usually show some syph-

Fig. 4.—Syphilitic dactylitis. Periosteal cloak, enlargement of bone, no destruction.

ilitic involvement. The bone somewhat resembles a well filled sausage in shape, the surface is even and regular in outline and in the early stage the cortex is of normal width, with a well marked though less dense periosteal thickening surrounding the shaft. Later the more compact layers of calcium are formed, and the sharp outline of the medullary cavity is obliterated. The cortex may appear at this period as a very thin sharp line of calcium deposit which may be easily indented. There is no trabeculation, as seen in giant-cell sarcoma, and no marked destruction or sinus formation as is usual in tuberculosis.

Craniotabes, lesions of the nasal bones, anomalies in ossification, high palate, hydrocephalic enlargement, Parrot's nodes and hydroplasia

of the teeth, when found, are useful in confirming the diagnosis when other syphilitic lesions are present. Gumma with marked bone destruction is extremely rare in the infantile type.

The bone lesions of syphilis tarda probably share with interstitial keratitis the first place among the late manifestations. The lesions usually take the form of an osteitis, periostitis or gumma. Though the lesions are frequently present at birth, their most frequent manifestation is between the fifth and fourteenth year (Holt). The tibia seems to

Fig. 5.—Late stage of syphilitic dactylitis, showing extreme degree of enlargement.

be the most common seat of the lesion, according to Fournier,[14] Findlay,[11] Albee[15] and Veeder and Jeans.[16] Codman[17] states that in the late form of congenital syphilis other bones are rarely found

14. Fournier: Leçons sur syphilis tertiaire, Arch. gén. de méd. **2**:290-301, 1889.

15. Albee: Orthopedic and Reconstruction Surgery, Philadelphia, W. B. Saunders Company, 1919.

16. Veeder, B. S., and Jeans, P. C.: Observations on One Hundred Cases of the Infantile Type of Hereditary Syphilis, Am. J. Dis. Child. **11**:177 (March) 1916.

17. Codman: The Use of X-ray and Radium in Surgery, in Keen, W. W.: Surgery, Philadelphia, W. B. Saunders Company **5**:1160, 1910.

affected unless the tibias are also affected. At times, the ends of the diaphyses may present the curious "punched out" appearance previously described.

The typical scabbard tibia, called by Fournier [14] the "tibia en lame de sabre," is fully described and discussed by Axhausen [18] and is considered by him to be pathognomonic of congenital syphilis. Fritzsche [19] however, has described a case in a woman, aged 54, who had been infected by her husband. The typical congenital case is modified to

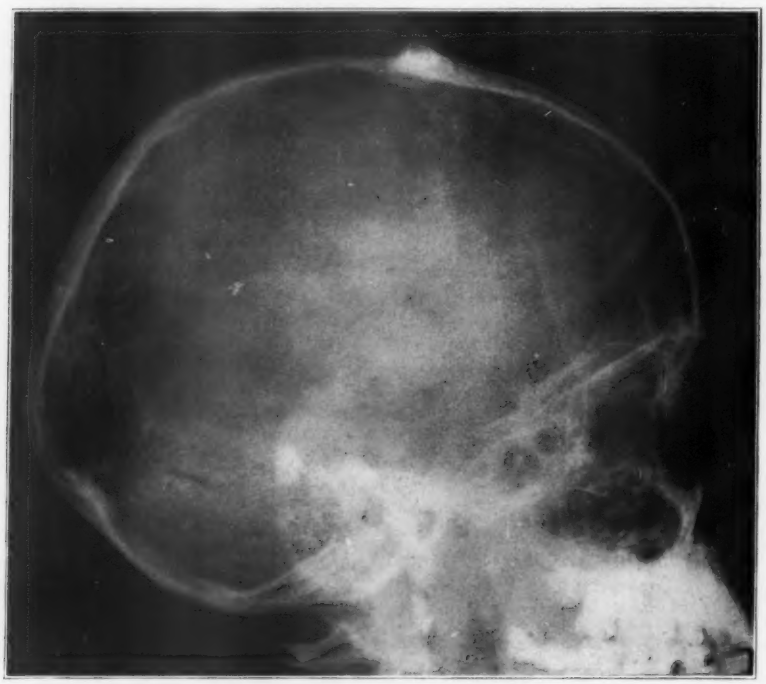

Fig. 6.—Parrot's node. Note the single dense nodule in the region of the bregma.

some extent by the location, degree and extent of the early granulation tissue and the amount of calcium deposition. Wallace [20] states that at times the different lamellae of calcium may be clearly seen by roentgenogram. The periostitis may be diffuse or local, and may vary in size from that of a small blister to a general diffuse involvement of

18. Axhausen: Beiträge zur Knochen und Gelenksyphilis, Berl. klin. Wchnschr. **1**:2361-2369, 1913.

19. Fritzsche: Die "Tibia en lame de sabre" als Folge der erworbenen Lues des Erwachsenen, Fortschr. a. d. Geb. d. Röntgenstrahlen **16**:23-26, 1912-1913.

20. Wallace, J. O.: J. Orthop. Surg. **1**:258-293 (May) 1919. (This article gives a full bibliography of bone syphilis to Jan. 1, 1917.)

the entire bone. The surface may be smooth and regular, lacelike, or at times even moth-eaten in appearance. The early lesions are likely to be somewhat hazy and irregular, while later, heavy calcium deposits are laid down parallel with the shaft and the surface becomes more or less smooth and regular. The calcium deposit is almost always in the

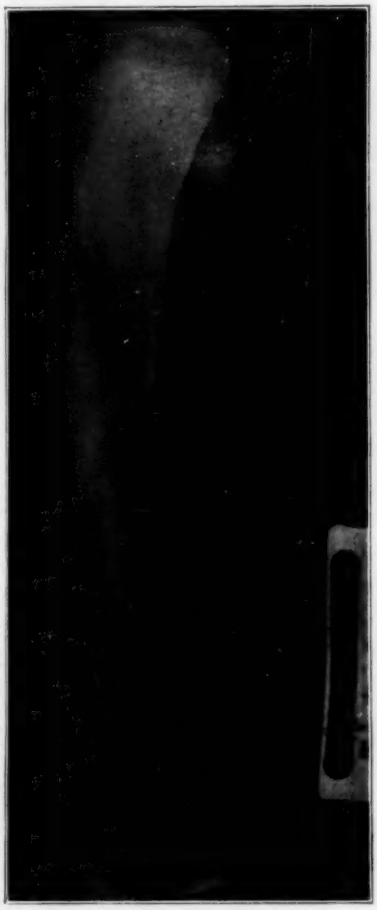

Fig. 7.—The typical congenital saber shin, named by Fournier the "Tibia en lame de sabre."

mid portion of the convex surface of the tibia but not necessarily. Bowing of the bone is only apparent as contrasted with rickets in which there is an actual bowing, usually of the lower third, either anteriorly, laterally or both. In the early stages the medullary cavity may appear normal, but later an ostitis is usually present, which modifies the picture somewhat.

As age advances the ostitis becomes more marked and the periosteal changes less marked. New bone is deposited not only on the surface but throughout each Haversian system and even in the spongiosum. The shaft of the bone becomes ballooned out and the outline of the medullary cavity is obliterated. The stage or type is very hard to differentiate from a chronic pyogenic osteomyelitis, although usually other syphilitic bone lesions are present which aid in the differential diagnosis.

Fig. 8.—Late stage of Wegner's osteochondritis, showing the curious punched out lesions.

The gumma and gummatous periostitis seen in the later stages of congenital syphilis are not uncommon. The long bones and the skull seem to be most commonly involved. The essential feature is localized bone destruction surrounded by well marked bone production, which becomes more marked as the age advances. In the skull the superior portion of the frontal bones near the bregma seem to be a common site although the lesions are found in the frontal, parietal or temporal regions. The lesions may be single but more often are multiple, and consist of numerous small, circular areas of bone destruction in which at times a definite sequestra may be perceived. The edges of the lesions are usually well marked, although in the early stage bone pro-

duction is not a marked feature. Later, bone production becomes more marked, and varying degrees of osteoscle sis and osteoporosis may be seen. Lovett and Wolbach [21] report tw. cases of tuberculosis of the skull which simulated syphilis very closely and it is needless to say that the differential diagnosis is difficult. Schuller [22] states that the bones having large air cells (temporal, sphenoidal and ethmoidal) seem to be a common site for tuberculous lesions, and that the tendency to bone production or osteophytic formation is less marked than that

Fig. 9.—A fairly extensive destructive gumma of the anterior surface of the right tibia in a child, aged 12 years.

seen in syphilis. Of the long bones, the tibia is the one most commonly affected, usually at the proximal end or in the upper third. There is no tendency to involve the joint. Small, subperiosteal gummas may occur, which later heal with the formation of large exostoses or

21. Lovett, R. W., and Wolbach, S. B.: Roentgenographic Appearance, Diagnosis, and Pathology of Some Obscure Cases of Bone Lesions, Surg., Gynec. & Obst. **31**:111 (Aug.) 1920.

22. Schuller: Roentgen Diagnosis of Diseases of the Head, St. Louis, C. V. Mosby Co., 1918, p. 112.

bosses. There also may be involvement of the medullary space, cortex and periosteum with large gummatous deposits, which may soften, suppurate, become secondarily infected and lead to the establishment of persistent sinuses.

Cystic lesions may occur in the later stages and are probably the end-result of the degenerative changes of the early osteochondritis or gummas seen in the ends of the diaphyses of the long bones. Barrie [23]

Fig. 10.—Congenital syphilis in a patient, aged 12 years. Note the extreme delicacy, atrophy and prominence of internal condyle.

states that cysts are somewhat commonly found in the congenital form of syphilis. The lesions are usually very clear and well defined and there is very little inflammatory reaction around the lesion. They conform more or less to the shape of the medullary cavity. The cortex is not involved and, as age advances, there is a tendency for the lesion to move toward the mid portion of the bone. If the lesion is single

23. Barrie, G.: Ann. Surg. **67**:354-363 (March) 1918.

and no sequestra is present it is hard to differentiate from a chronic sterile abscess.

Joint involvement is not rare and is most common in the knee. The various arthritides have been variously classified as arthralgia, synovitis, hydro-arthrosis, osteochondro-arthritis, etc. The early changes are essentially a proliferative inflammation of the synovial membrane, with a pouring out of a thin serous fluid which fills the joint. The joints

Fig. 11.—The other elbow of patient in Figure 10. Note the union of the epiphysis of the head of the radius and the punched out lesions.

most frequently affected are the knees, elbows, hips and ankles. The lesion is usually painless, many times bilateral, and responds well to treatment. The roentgenograms are usually negative, except for the swelling of the soft parts and the evidence of fluid in the joint.

The atrophy (Fig. 10) and slight maldevelopment (Fig. 11) of the bones which produce the extreme delicacy, irregular ossification and small size disappear slowly even under treatment, while the more

extensive localized lesions usually respond well and may entirely disappear. Stoll [24] has called attention to what he terms the "knock-knee elbows" or an increase of the normal carrying angle, due apparently to an overgrowth of the external condyle of the humerus which throws the forearm to the outer or radial side. Considering the extensive involvement many times seen at the epiphyseal line, it is somewhat surprising that we do not find more cases of faulty development or malformation during the period of skeletal growth.

COMMENT

As in other tissues, the reaction of bone to the spirochete varies, depending on the virulence of the organism and the immunity of the individual. As age advances, other factors such as secondary infection, surgical intervention or direct trauma also enter into the differential diagnosis. While certain peculiar types of congenital bone syphilis present a more or less characteristic feature, we must remember that they are by no means invariable, and that this common disease often manifests itself in many odd ways.

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24. Stoll, H. F.: The Clinical Diagnosis of Heredosyphilis, J. A. M. A. **77**:919 (Sept. 17) 1921.

DERMATITIS DIPHTHERITICA *

REPORT OF CASE

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That the Klebs-Loeffler bacillus may produce cutaneous eruptions is well known. Dermatitis diphtheritica may be primary, or, which is usual, may result from contamination from mucous membrane lesions. These secondary eruptions were, until the introduction and wide spread use of diphtheria antitoxin, not uncommon. On the other hand, primary cutaneous diphtheria is either very rare or, because not very often diagnosed, commoner than is generally thought. This undoubt-

Primary diphtheria of the face, showing crusted eczematiform lesions on right and left cheeks, buccal commissures and at the labionasal junctions.

edly is due to the fact that the lesions produced by the diphtheria bacillus primarily on the skin are not always the same. Unlike impetigo, for example, there is an absence of the same elementary or distinctive form. Consequently the only certain means of diagnosis is bacteriologic (smear, culture, guinea-pig inoculation) and the Shick test. This test is an excellent aid to a specific diagnosis. Even with a positive smear

* Received for publication, April 18, 1924.

* From the Department of Dermatology and Syphilology, Clinic of Dr. J. Frank Schamberg.

and culture, the Shick test is in order, as a biologic means of definitely differentiating the true Klebs-Loeffler organism from the diphtheroid or pseudodiphtheritic organisms so common on the normal or pathologic skin. The therapeutic test is final.

The treatment of the case reported, for more than three weeks for what was thought to be an eczematized impetigo, indicates the necessity for the studies before mentioned in all of the perinasal and perioral crusted fissured lesions in children. The importance of discovering active diphtheria carriers of this sort is obvious.

REPORT OF CASE

E. W., a colored boy, aged 12, was referred to the skin clinic by the eye department, with the history that the boy had originally presented himself at that clinic with an eczematous eruption, redness and swelling of both lids of the left eye. When questioned, he stated that about three weeks previously, he had developed a stye on the left eye, and following the use of a simple salt solution, irritation, scabbing and pus in the inner corner of the eye developed. This spread to the cheek.

On examination, we found a dry crusted reddened eczematiform eruption present on the left lower lid and on both cheeks, fissuring at the buccal commissures and fissures at the junction of the alae nasi and nasal septum with the upper lip. For almost three weeks he was subsequently treated for what was supposed to be a simple eczematized impetigo. Our suspicions were aroused when the applications usually specific for impetigo failed to produce any impression on the eruption. Cultures from the fissures were positive for the Klebs-Loeffler bacillus, although a second examination both of the skin and the nasal mucosa was negative.

The patient was given 3,000 units of diphtheria antitoxin intravenously. Within twenty-four hours there was fully 90 per cent. improvement. Ten days later the fissures were but vestiges of what had previously been present. Another culture at this time was positive for the Klebs-Loeffler bacillus.

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ROENTGEN-RAY STUDIES OF STOMACH FUNCTION*

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Reviewing the literature, one finds that a surprising paucity of work has been done in roentgen-ray examination of the infant stomach, and that workers disagree strikingly in their observations and conclusions. Of ten significant articles written on the examination of the infant stomach, only three appear in English. The others are in German.

The present work was undertaken as a preliminary step in the investigation of the so-called "peristolic" function of the stomach (discussed in detail on page 69). In addition to presenting our observations and conclusions concerning the form, size, position, air bubble and emptying-time of the stomach, this work may also serve as a résumé of the existing literature on the examination of the infant stomach by roentgen ray.

REVIEW OF THE LITERATURE

Before stating our findings it will be of interest to review the results and opinions of the chief workers in this field.

The question of stomach form has caused more difference of opinion and discussion than any other of the gastric functions. This is, perhaps, partly due to a difference in the interpretation of results ("personal equation") as well as to the numerous factors which affect the various properties of the organ.

Leven and Barret [1] think that the consistency of the food plays the greatest rôle in the filling and form of the stomach. Flesch and Péteri [2] agree with this point of view, and add that the quality of the feeding is of distinct influence on the development of the form of the gastric organ.

Alwens and Husler [3] describe three types of stomach, which result from: (1) Drinking fluids in the vertical position, (2) drinking fluids in the horizontal position, (3) taking gruels of thick consistency in the vertical position. The basis of this classification is the air bubble. As a result, it is stated that the difference in expansion in various organs

* Received for publication, May 15, 1924.

* From the Kaiser and Kaiserin-Friedrich Krankenhaus, Berlin. Clinic of Prof. H. Finkelstein.

1. Leven and Barret: Radioscopie gastrique, forme, limite, influence, mode de remplissage et d'évacuation, Presse méd. **14**:503, 1906.

2. Flesch and Péteri: Ergebnisse von Magenuntersuchungen mittels Roentgenstrahlen im Säuglings und späteren Kindesalter, Ztschr. f. Kinderh. **2**:263, 1911.

3. Alwens and Husler: Roentgenuntersuchungen des Kinderlichen Magens, Fortschr. a. d. Geb. d. Roentgenstrahlen, **19**:3, 1912.

does not depend on the consistency of the food, but on the amount of air swallowed.

Thus, in Type 1 (Fig. 1 a), resulting from fluids in the vertical position, there is a tendency to swallow a great deal of air, resulting in an expanded fundus. The pyloric antrum is narrow and extends to the right, beyond the vertebral column. This type they regard as an illustration of the antagonistic action between the pylorus and the fundus, described by Kreuzfuchs.[4]

In Type 2 (Fig. 1 b), resulting from fluids in the horizontal position, the air bubble is, of course, not visible. One sees the stomach as a smoothly outlined conical shape with a circular area at the left, expanded portion, corresponding to the air bubble.

Type 3 (Fig. 1 c) is described as occurring with thick gruels, the child in the vertical position. A minimum amount of air is swallowed. The stomach assumes an oblique shape and the pylorus is small.

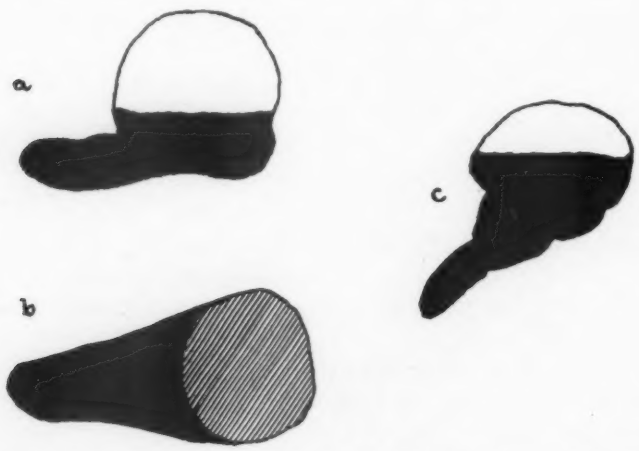

Fig. 1.—The three types of stomach of Alwens and Husler: (*a*) with fluids, vertical position; (*b*) with fluids, horizontal position; (*c*) with gruels, vertical position.

Theile [5] disagrees with all these former conceptions of stomach form, and iconoclastically states that the amount and consistency of food, as well as the amount of air swallowed, have nothing at all to do with the form of the stomach. He believes it depends on the tonicity of the musculature. In consequence, Theile describes two main forms of stomach, which may occur with large as well as small air bubbles. These forms are: (1) the "dudelsack" or "bagpipe" form of Leven and

4. Kreuzfuchs, S.: Die Magenmotilitat in Radiologischer Beleuchtung, Wien. Med. Wchnschr. **62**:1070, 1912.

5. Theile, P.: Zur Radiologie des Säuglings Magens, Ztschr. f. Kinderh. **15**:152, 1916.

Barret, which occurs horizontally, and which may take the shape of an ellipse, pear or sandal (Fig. 2 a); (2) the "tobacco pouch" form of LeWald and Pisek,[6] with an expanded, upper portion and a narrow, lower portion, which may also resemble the outline of a frying-pan, the head of a pipe, or a retort (Fig. 2 b). Theile also admits of an infinite variety of transitional forms which occur, and he supplements his work with a whole page of peculiar sketches, only the most interesting of which are reproduced here (Fig. 3).

Finally, Lewald and Pisek state that there is no definite type of stomach in the infant. They have, however, observed three most frequent forms, classified as follows: (1) ovoid or Scotch bagpipe form of Flesch and Péteri, (2) tobacco pouch or retort shape of Alwens and Husler and (3) pear-shaped form with base above and to the left.

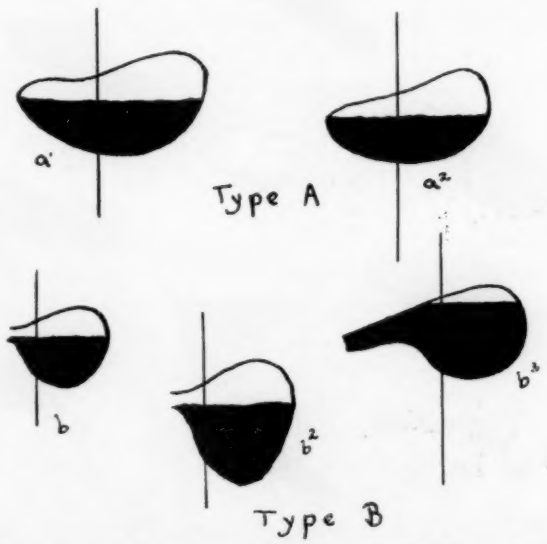

Fig. 2.—The types of stomach according to Theile: (*a*) "Dudelsack" form of Leven and Barret; (*b*) "Tabaksbeutel" (LeWald and Pisek) and retort forms.

Long axis.—Concerning the long axis of the stomach, again there occurs a divergence of opinion. Pisek and LeWald, Leven and Barret, Flesh and Péteri, and Trumpp[7] describe the stomach as lying horizontally rather than vertically. Tobler and Bogen,[8] on the other hand,

6. Pisek, G. R., and LeWald, L. T.: The Further Study of the Anatomy and Physiology of the Infant Stomach Based on Serial Roentgenograms, Am. J. Dis. Child. **6**:232 (Oct.) 1913.

7. Trumpp, J.: Roentgenologische Untersuchungen über den Ablauf der Verdauung beim Säugling, Verhandl. d. Gesellsch. f. Kinderh. **24**:490, 1907.

8. Tobler and Bogen: Ueber die Dauer den Magen Verdauung der Milch und ihre Beeinflüssung durch verschiedene Faktoren, Monatschr. f. Kinderh. **7**:12, 1908.

describe a vertical position, which occurs after feeding 100 gm. of milk. Alwens and Husler have observed a diagonal position of the stomach, common after thick gruel feedings.

Emptying time.—This question has been fully dealt with and carefully discussed by other workers. A résumé of results follows: LeWald and Pisek, one hour; Theile, within two hours; Einhorn, from one and one-half to two hours; Langstein and Meyer, from one and one-half to two hours; Leven and Barret, from one and three-fourths to two hours; Flesch and Péteri, from two to two and one-half hours; Alwens and Husler, three hours; Tobler and Bogen, from two to four hours.

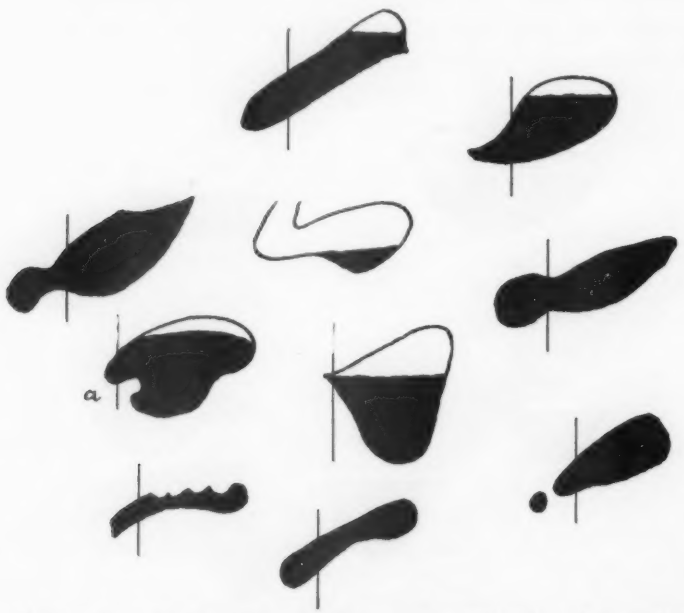

Fig. 3.—Various, transitional, stomach forms (Theile). (*a*) probably due to gas indentation and really oval in form.

Einhorn [9] states that emptying time is increased for artificial foods and proprietary remedies. Others have determined that length of digestion is dependent on concentration of food and content. It proceeds parallel with the casein content of the milk and, therefore, women's milk, half-milk and malt-soup are relatively quickly emptied, while whole milk, albumin and buttermilk are digested comparatively slowly. Fat lengthens digestion time (Theile). Smaller amounts of food take longer than larger amounts (Tobler).

9. Einhorn, M.: The Time Required in the Stomach for Digestion of Different Foods in Infancy, New York M. J. **50**:67, 1889.

METHOD OF PROCEDURE

Approach to the problem was made by fluoroscopic and roentgenographic examinations of the stomach, with observations concerning its position, form, size and air bubble. We have noticed how foods of varying concentration and consistency affect these various factors of stomach function in different types of children within the first year of life.

First we examined normal infants fluoroscopically from three to four hours after their last meal, to insure an empty stomach (in practically all cases the stomach was empty within three hours).

The child was then given 100 gm. of its usual feeding. The quantity was kept uniform in all cases, except those few dystrophic infants that could not be made to drink their bottles completely.

Fluoroscopic examinations were made: (*a*) immediately after feeding, (*b*) fifteen minutes after feeding, (*c*) one hour after feeding, (*d*) two hours after feeding and (*e*) three hours after feeding.

In later cases, we discontinued all examinations but those before feeding and those directly after, since the question of emptying time had already been sufficiently studied and, furthermore, when making roentgenograms, we thought it best to decrease the element of danger to the infants, so far as possible, by eliminating all unnecessary exposure to the roentgen rays.

Although the majority of workers have used barium or bismuth in their roentgen-ray examinations we decided to work without them. They not only make the feeding abnormal in consistency, but probably exert some physiologic effect on the stomach mucosa and musculature, which we wanted to eliminate. Hence no contrast mediums were used, and we were able to see the stomach and surrounding landmarks quite clearly.

We made roentgenograms of the interesting cases. Here again neither barium nor bismuth was used, thus insuring an absolutely natural appearance of the stomach, without the disturbing influence of various drugs. Roentgen-ray pictures were always preceded by fluoroscopic examination as a control. Pen sketches were made following each fluoroscopy. These sketches, a number of which are included in this paper, invariably corresponded quite accurately with the roentgenograms of the stomach in regard to form, comparative size, position and air bubble. In any case, only a few moments, long enough to set a plate in position, elapsed between the fluoroscopic and roentgenographic examinations of a patient.

Length of Exposure to Roentgen Rays.—The sensitiveness of the child's organism to the roentgen rays increases with the youth of the individual (Theile), and it was therefore necessary to reduce the length of exposure to a minimum. No examinations lasted more than three or four seconds, which suffices for the accustomed eye. Occasionally a

second, short exposure was necessary. Infants examined, of which the youngest was 5 weeks old, never showed any injury from the roentgen ray. In normal, or in gaining children, the weight curve continued to rise. Only one child showed slight fever. This patient was dystrophic and had been having mild infections at frequent intervals for months. Even this patient, however, continued the average gain in weight, and the slight fever disappeared within two days.

Arrangement of Apparatus.—The child was held vertically, with its back to a stretched canvas, behind which the camera was set. The plate was held in position before the child, in contact with, but not pressing on the abdomen (Fig. 4). Camera, child and plate were held at fixed distances, so that the variations in size of the organ may not be explained by varying distances of the patient from the camera or plate. Exposures were made at 60 cm. from the anticathode, at the moment of maximum inspiration, when the child appears most quiet, whether it was crying

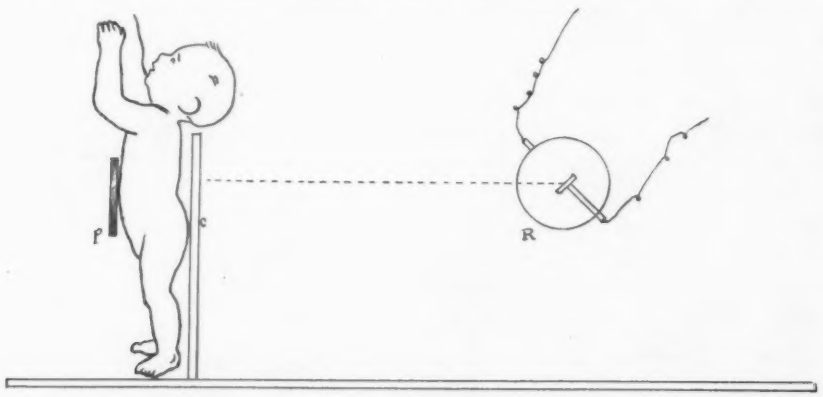

Fig. 4.—Arrangement of child and apparatus: p, plate, c, canvas, r, rotengen-ray camera.

or not. In some very active children it was difficult to avoid slight motion.

Feedings Used.—1. At first the child was always examined with its usual feeding, to which the stomach had become accustomed. This was generally a milk of moderate dilution with a carbohydrate supplement, such as two-thirds milk with 8 per cent. sugar, or whole milk with 10 per cent. sugar, etc., given by bottle.

2. The second examination was made with a concentrated, fluid nourishment of higher caloric content than the usual formula, such as albumin milk with 20 per cent. sugar, or "Moro" milk (whole milk with 3 per cent. butter, 4 per cent. flour and 6 per cent. sugar).

3. Finally, for a third examination, a thick cereal gruel or mush of vegetables and potatoes was given by spoon. This mush was made so thick that it clung to the suspended spoon.

In the use of cereals prepared with milk, we found that, after the child had taken its feeding, and the fluoroscopic examination was made, the stomach contents showed a fluid wave, demonstrable by moving the patient from side to side. We thought that our cereals were not thick enough, so we had them prepared that they clung to the spoon almost as a solid mass. Still the fluid wave appeared on the screen. This result was quite unexpected and it puzzled us at first.

It was then suggested that perhaps the warmth of the body tended to decrease the consistency of the cereal and make it fluid. It was clear that our semisolid, cereal feeding had become fluid inside the stomach in the short time taken by the child to complete its meal (about fifteen minutes).

To establish the cause definitely I performed an experiment in vitro. A small amount of the thick cereal was placed in a beaker, which was in turn placed into a larger vessel of water heated to body temperature. In several minutes the cereal lost its semisolid form and became progressively more fluid in consistency. So one may explain the thinning of a thick cereal in the stomach on the basis of admixture with saliva plus the influence of the body warmth.

We then determined to use a gruel of mashed potatoes or vegetables, or a mixture of both. These purées were not influenced by body heat and proved satisfactory for our experimental work. They show a much more striking effect on size, form, etc., of the stomach than cereals prepared with milk.

OBSERVATIONS

The Empty Stomach.—We found the empty stomach difficult to observe. A great deal of gas in the colon of most children obstructed the view, and it was generally by the absence of a fluid shadow in the stomach area that one could say the organ was empty. In some infants, with less gas in the intestines, the stomach was more clearly visible. In these cases we found the organ in the upper left quadrant, close to the diaphragm and extending approximately to the vertebral column on the right.

The Filled Stomach.—The shadow of the filled stomach, whatever its form, consists, on the plate, of an upper, deeply shaded portion, the air bubble, and a lower segment, less intensely shaded, the food content. By these two shadows one can define fairly well the outline and form of the stomach. Such disturbing factors as liver or gas-filled colon help to make the picture more indistinct at times, and they often indent the normal outline of the stomach, but they are obviously unavoidable. Many children had to be reexamined because of too much gas, which fairly obliterated the lower portion of the stomach.

The filled stomach, just after a fluid meal, appears in the upper, left quadrant, between the tenth and twelfth thoracic vertebrae, close to the

diaphragm, and commonly extending a bit beyond the midline to the right. At times, it is partly covered by the liver. The cardiac end always remains fixed, while the pyloric extremity, being suspended from the ligamentum hepatoduodenale, is mobile and changes its position with the varying size and form of the stomach.

The Long Axis.—Concerning the long axis of the stomach, our observations have shown the organ to lie, almost without exception, in a horizontal plane. In just one infant did we find the stomach assume an oblique position with Moro milk, toward the end of the digestion period (Fig. 5).

Fig. 5.—Stomach with 100 gm. Moro milk, two hours after ingestion, showing our only case with oblique position. Note the gas indentations in the lower outline, from colon gas.

Fig. 6.—Case with 100 gm. concentrated, albumin milk gruel, showing our only case in which the vertical diameter was greater than the horizontal diameter. Here the organ is probably rotated so that the pylorus is not visible.

Stomach Form.—The difference of opinion concerning the form of the stomach is, perhaps, in part, due to the numerous factors which can affect this function. The amount of air swallowed; amount of food ingested; tonicity and elasticity of the gastric musculature; condition of the surrounding organs, especially with respect to gas content; configuration of the abdominal cavity, in turn influenced by respiratory movements, crying, body position, etc.; tensity of the abdominal wall and width of the thoracic aperture, all influence the form, position and size of the stomach.

It is very likely that the grotesque, transitional form of Theile (Fig. 3 a) was really oval and smooth in its lower, as in its upper curve. Gas in the intestines will often obliterate the true stomach form and give the confusing impression of a form that does not exist.

It is our observation that, despite a great many variations of stomach outline under varying conditions which could not be controlled, there exist but two distinct forms of stomach in infants, which may be regarded as types. All other forms can only be considered as belonging to one of these two groups, which change in outline under varying influences. We have observed a very long, narrow stomach; a pear-shaped stomach; an oval or elliptical form; a retort shape; a giant organ and a very small, circular outline. We found that the very long, narrow stomach (Fig. 7 a), with indentations of the curvatures, was due to

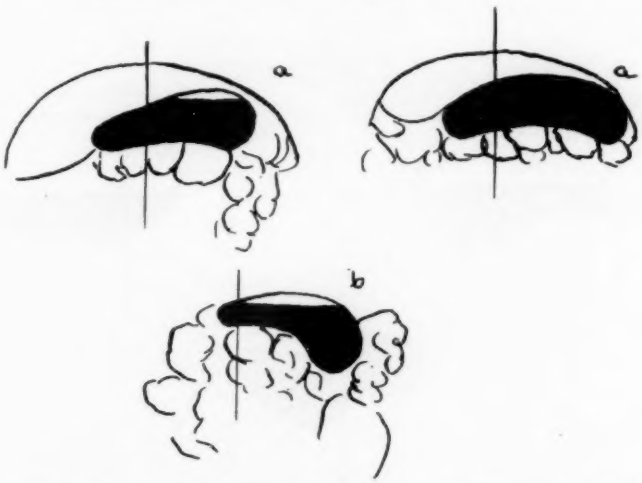

Fig. 7.—(*a*) Flat forms of stomach observed. The organ lies on a cushion of gas formed by the gas-filled intestines. (*b*) Retort shape, wherein the concavity of the greater curvature is caused by the upward pressure of gas in the colon.

pressure between the diaphragm and the intestines, and that this flat stomach might become very full and round under other conditions. The giant stomach with much air may become very small and round, with hardly any air content. The pear-shaped form may appear circular or oval and the retort shape is due to the fact that the organ lies on the gas-filled colon, which acts as a cushion and supports it (Fig. 7 b).

Hence we can describe but two very common types of infant stomach, both of which occurred, in our cases, with fluid feedings.

Type 1.—The stomach appears to be like the shape of a pear or flask, lying on its side (Fig. 8 a), in a horizontal plane, and extending just beyond the midline to the right. This form varies slightly, due to

gas pressure from without, but, in general, it retains the outline described. The air bubble varies in size and shape. In this type, due to the expanded fundus on the left and the long, narrow, pyloric region on the right, the fold of the stomach appears strikingly as a curved, vertical line, extending from the upper to the lower border and dividing the organ into an approximately right and left half ("S.F." in Figs. 8, 9 b, 10, 13).

Type 2.—A second type, with fluid feeding, but less common than the first, is a smooth, elliptical or oval form with moderate air bubble, also horizontal in position and extending to or just beyond the vertebral column (Fig. 8 b).

These two forms occurred with all fluid feedings, whether whole milk, albumin milk, Moro or other milk formulas. Concentration or

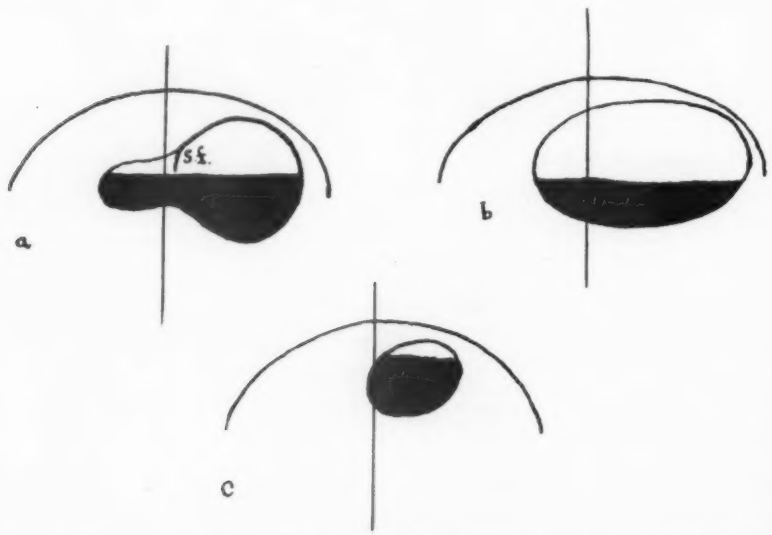

Fig. 8.—The two types of fluid stomach (Rogatz). (*a*) pear-shaped, horizontal; (*b*) smooth, oval, horizontal; (*c*) a third form of stomach found with thick gruels: small, circular and with a minimum amount of air.

caloric value seemed to have no influence on configuration. A pear-shaped organ retained its form, regardless of content, so long as the feeding remained fluid. The same applied to the oval form.

Now we must describe a third form of stomach, which occurred regularly in each of the above types, when thick gruels or feedings of otherwise thick consistency were given. It mattered not whether the stomach conformed with Type 1 or Type 2. When a thick mush of vegetables or mashed potatoes was given, both stomach forms assumed a distinctly smaller, rounded form, generally circular, with a tiny air bubble (Fig. 8 c).

We took pictures of a whole series of cases which demonstrate this fact clearly, and indicate unequivocally the existence of a function of the stomach, not frequently discussed. This quality of the stomach to contract under the influence of thick foods and its significance are more fully considered in a later article. Figures 7 and 8 demonstrate this ability of the stomach to react to foods of thick consistency.

Air Bubble.—All children are aerophagic. Some children swallow more air than others. It is commonly agreed that a child on the breast swallows a minimum amount of air during its feeding, and that feeding by spoon is also conducive to small air-bubble formation. However,

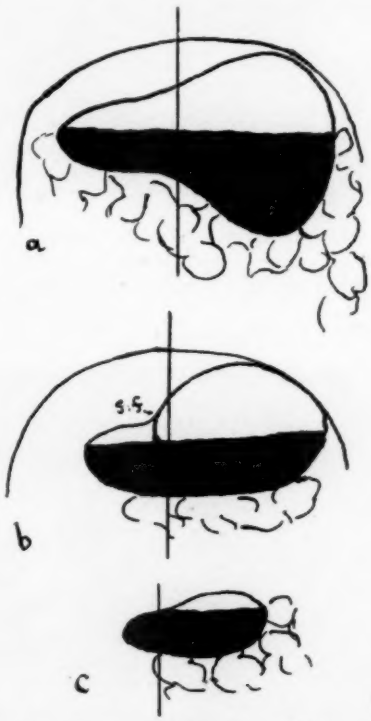

Fig. 9.—Case with (*a*) giant stomach after 100 gm. albumin milk with 7 per cent. sugar; (*b*) after concentrated, albumin milk gruel; (*c*) with mashed potato, showing the moderate influence on size of concentrated albumin milk gruel and the striking change with thick, mashed potato.

we have not been able to determine any distinct difference between the air bubble in children with various fluid feedings, whether given on the breast, from the bottle or by spoon. Petrey, Alwens and Husler and others have had similar results.

The air bubble is, however, to a certain extent, dependent on the consistency of the food given. Whereas much air is swallowed during fluid feedings, practically none, or very little, is swallowed with thick

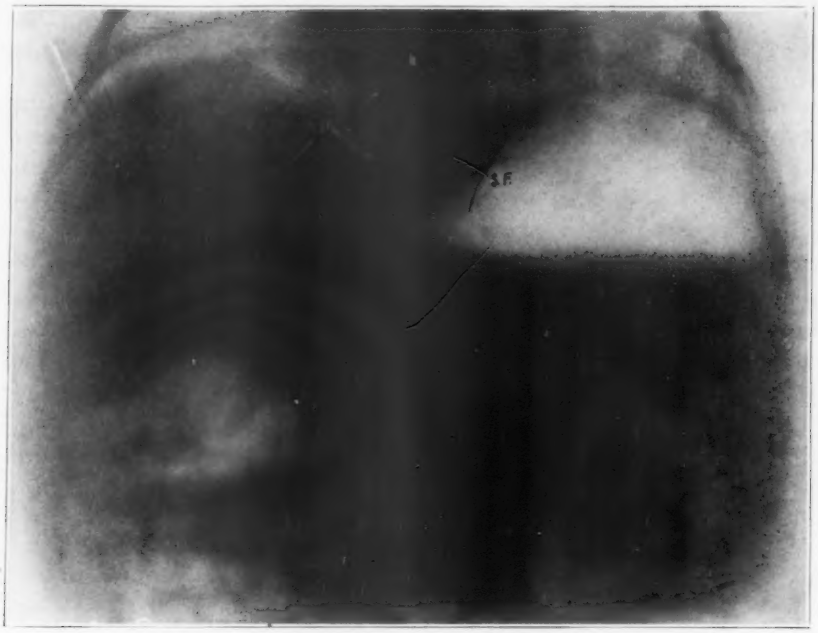

Fig. 10.—Roentgenogram of stomach of a child, two months old, with 100 gm. breast milk, showing the typical, pear-shaped, fluid stomach, horizontal and extending beyond the midline. Large air bubble. Stomach fold, ("s.f.") described in text.

Fig. 11.—Same as Figure 10, with 100 gm. two-thirds milk and 8 per cent. sugar, showing slight variation in form and size, horizontal and extending beyond midline. The air bubble is approximately one-half of the stomach content.

gruels or purées. Those children, who do swallow air despite the thickness of the feeding, seem to belch very easily after the meal and at the slightest provocation.

The air bubble toward the end of a fluid meal is about one-third to one-fourth the whole stomach area (Lust [10]).

Peristalsis.—We have not been able to observe peristaltic waves in the stomach outline by virtue of the very short exposures made with the fluoroscope. Our plates do not show the peristaltic waves. Theile, however, has been able to demonstrate them.

Emptying Time.—There is little that we can add to the carefully worked out studies on this point. In measuring the length of time necessary for the stomach to empty, we used Demuth's [11] suggestion of measuring from the moment of drinking and not from the end of the meal, since digestion begins when the first drops have entered the stomach.

Digestion varied with the person. Patients with habitual vomiting or spitting, or those sick in other ways, took longer to digest their food. Neuropathic patients and those with poor appetites had an increased emptying time. The stomachs of children who were allowed to be hungry emptied more quickly than normally. In two children, accidentally postponed beyond their normal feeding time, we found a hurried emptying of the stomach, probably influenced by hunger.

COMMENT

The Long Axis.—Our observations have shown the stomach to lie horizontally in practically all cases. We noted one exception in which, after Moro milk, the stomach assumed an oblique position. The vertical position, described by Tobler and Bogen as occurring after a feeding of 100 gm. of milk, has not been demonstrable in our work, except, perhaps, in one case (Fig. 6), and in this child it is impossible to say that the pylorus had rotated through an angle of 90 degrees to a position diametrically below the cardia, as Tobler and Bogen imply. Alwens and and Husler describe a diagonal position of the stomach, common after thick, gruel feedings. Here again, however, our results differ. We must agree with other observers (Leven and Barret, Flesch and Péteri, Trumpp, etc.) that the long axis of the infant stomach is most commonly horizontal in contrast to the adult stomach. In this connection Simmonds [12] notes that as soon as the child stands up and walks the horizontal position is lost and the stomach assumes a vertical form in 75 per cent. of human beings.

10. Lust, F.: Zur Pathogens der Rumination im Säuglingsalter, Monatschr. f. Kinderh. **10**:316, 1912.

11. Demuth, F.: Magenprufung beim Gesunden Säugling, Ztschr. f. Kinderh. **33**:276 (July) 1922.

12. Simmonds, M.: Ueber Form und Lage des Magens unter normalen und abnormen Bedingungen, Jena, Gustav Fischer, 1907.

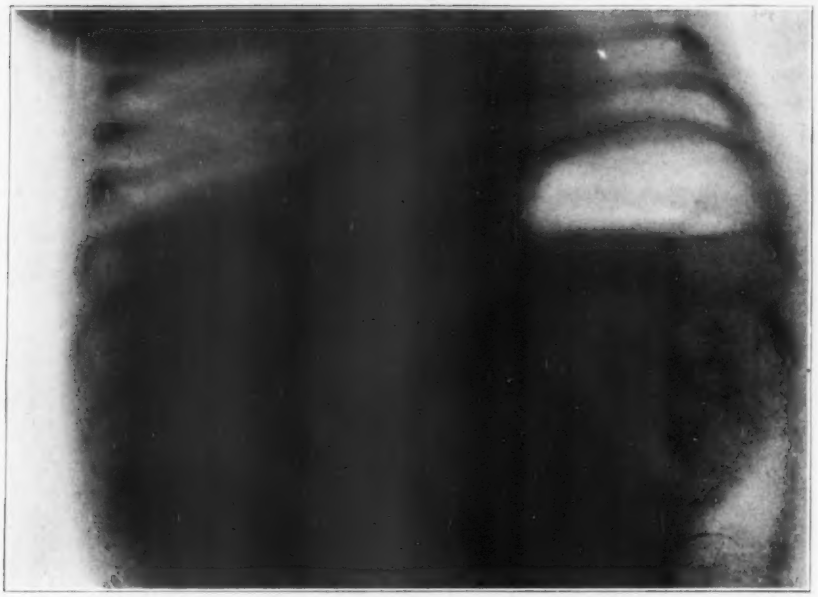

Fig. 12.—Same as Figure 10, with 100 gm. of a thick mush consisting of mashed potato and vegetables. The greater curvature is obliterated by gas in the colon at the splenic flexure. However, the air bubble indicates that the stomach is distinctly smaller than in Figures 10 and 11, oval and does not extend beyond the midline.

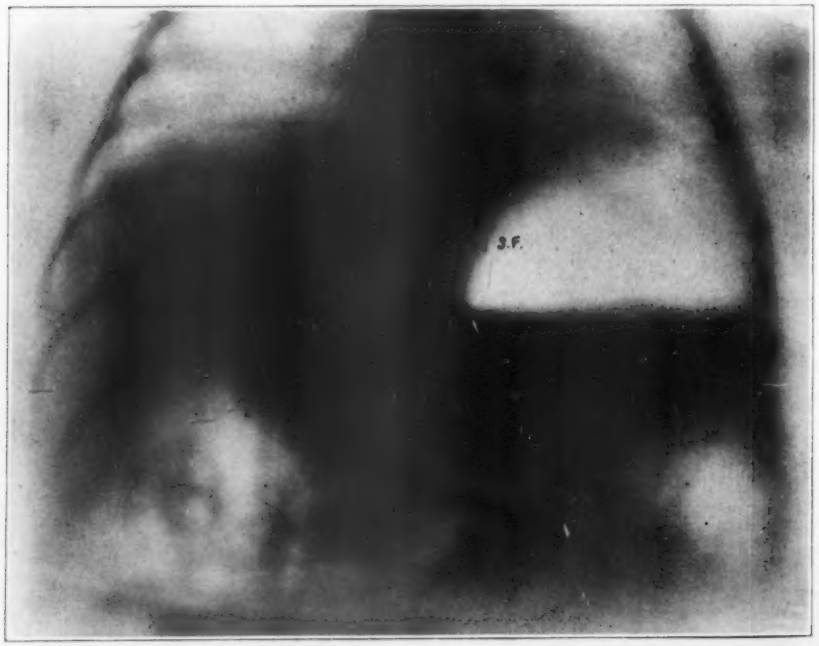

Fig. 13.—Stomach roentgenogram of a child, 3 months old, with regurgitation. Feeding was 100 gm. two-thirds milk with 8 per cent. sugar. The typical fluid shape is shown, large air bubble and stomach fold ("s.f.").

Stomach Forms.—Theile claims that the tonic state of the gastric musculature may have much to do with stomach form. This is true. But, assuming a normal musculature of average tonicity, all other things being equal, consistency of food has a great deal to do with form. Even in a stomach with apparently poor muscular contractility in fluid diet, it is possible, by feeding a thick food, to cause the stomach to assume a very small, contracted form. Figure 9 shows the case of a child with a giant stomach due to atony. The organ extended almost to the right abdominal wall. This large form, with immense air bubble, was found with fluid diet, regardless of concentration of food elements. When gruel made of half-milk and vegetables was given the organ assumed a somewhat smaller size (Fig. 9 b) and, with a thick feeding of mashed potatoes, the stomach contracted down remarkably. A minimum of air was swallowed, an indication of the influence of foods of thick consistency (Fig. 9 c).

Of course, the amount of air swallowed also affects form. But, commonly, this element is also dependent on the thickness of the feeding, as has already been indicated.

It is clear that much of the confusion regarding stomach form arises from the failure to distinguish clearly between "types" and "forms." We can describe but two very common types of stomach, which occur with fluid feedings, regardless of concentration or caloric value. These two types may assume a third form common to both, when food of thick consistency is given, that is, the small, rounded, contracted form with tiny air bubble, already described.

In Alwens and Husler's classification they describe three "types" of stomach (mentioned in the review of the literature). They differentiate between the forms of the stomach obtained from drinking fluids: (*a*) in the vertical position, (*b*) in the horizontal position. Now the view obtained with the child in the horizontal position is really nothing more than a top-view of the vertical form. A side-view of the horizontal "type" must correspond with "Type" a, and hence there is no particular point in considering the horizonal view as a special type of stomach. One may photograph the stomach from a number of angles and obtain as many different "types" by this method.

SUMMARY

1. Owing to a scarcity of literature and a divergence of opinion on the examination of the infant stomach by the roentgen ray, our work was undertaken for the purpose of studying the various functions of the infant stomach.

2. Procedure. Fluoroscopic examinations and roentgenograms of the stomach were made at regular intervals before and after meals, with observations concerning form, size, position, air bubble, peristalsis and emptying time.

3. Three types of feeding were used with each child: (1) a milk of average caloric value, (2) a concentrated milk, (3) a gruel or mush of thick consistency.

4. No contrast mediums were used.

CONCLUSIONS

1. A gruel or cereal made with milk, no matter how thick it is before ingestion, becomes fluid in the stomach under the influence of saliva and body heat, whereas a food of mashed potato or vegetable mush retains its consistency.

2. The empty stomach is difficult to see with the fluoroscope. The filled stomach is clearly visible without contrast mediums and lies in the upper, left quadrant of the abdomen, close to the diaphragm, extending in a horizontal plane to or just beyond the midline.

3. The stomach shadow on the plate may be defined by an upper, deeply shaded portion (the air bubble) and a lower, less intensely shaded area (the contents).

4. The air bubble varies in size, shape and form in all stomachs, with fluid content, but it is distinctly smaller, or often absent, when thick gruels are swallowed.

5. There are two main, constant types of stomach with fluid feedings, in the infant. Both are horizontal and extend to or just beyond the vertebral column to the right.

Type 1.—The shape is that of a pear or a flask lying on its side, with a large, circular, expanded fundus and a smaller, narrow pyloric area.

Type 2.—Occurs less frequently and is smooth, elliptical or oval in shape.

The above two types may assume a third form, common to both, when thick gruels are ingested, namely, a small, circular or oval form, about one-third the size of the fluid forms, with little or no air bubble at all.

ROENTGEN-RAY STUDIES OF STOMACH FUNCTION: THE PERISTOLIC FUNCTION *

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In the first paper [1] of this series, the important question of peristolic function was summarily mentioned. In view of the significant and successful practical application made possible by the definite acceptance of this function as a basis for reasoning, I wish to devote this paper to a more detailed explanation of our procedure and the results obtained.

We became aware of the existence of the peristolic reflex in the course of our roentgenographic work on the gastric functions in infants. As our study progressed, and our observations increased in number, we were able to establish with absolute certainty the existence of a so-called "peristolic function" of the stomach, entirely different from and not to be confused with the more familiar peristaltic function.

It is perhaps best at this point to define terms. Peristalsis may be described as a circular wave of contraction, appearing at regular intervals, which begins at the fundus and progresses toward the pylorus of the stomach. These movements aid digestion by mixing the food thoroughly with the gastric juice to form chyme, and by propelling the food onward. This peristaltic function also appears in the intestines as a constriction of the walls, which, "beginning at a certain point, passes downward, away from the stomach, from segment to segment, while the parts behind the advancing zone of constriction gradually relax." [2]

Peristolic function is only demonstrable in the stomach, and may be described as that capacity of the stomach wall to surround or grasp its contents following the ingestion of food. We first noticed this action in our fluoroscopic examinations and were able to demonstrate it in later exposures by the roentgen ray. A number of these pictures are reproduced here (Figs. 2, 3, 4 and 5).

The literature on "peristolic function" is scant. Lindberg,[3] who, in a recent article, points out that this function owes its name to Stiller, successively denies and affirms its existence. He further mentions that Leven and Barret, Epstein and others also deny its existence.

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* Received for publication, May 15, 1924.

* From the Kaiser and Kaiserin-Friedrich Krankenhaus, Berlin. Clinic of Prof. H. Finkelstein.

1. See page 53, this issue.

2. Howell, W. H.: A Text-Book of Physiology, Ed. 6, Philadelphia, W. B. Saunders Company, 1917, p. 725.

3. Lindberg, G. L.: Atonic Insufficiency of the Stomach a Cause of Vomiting and of Lack of Appetite in Infants, Am. J. Dis. Child. **27**:197 (March) 1924.

Theile [4] has published a very extensive review of the work done, but in none of it is there more than a passing mention of the peristolic function, and that in one article by Flesch and Péteri,[5] who also claim that, according to their observations, it is impossible to demonstrate a peristolic reflex. Theile, who has also presented the most complete study of the infant stomach by roentgenographic means, devotes no more than a passing "impression" to the subject.

This seems the more remarkable, since we were so impressed by the striking evidence of peristolic function in infants. In a very recent

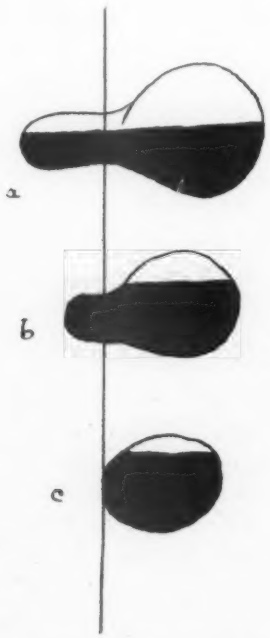

Fig. 1.—A diagrammatic representation of a typical infant's stomach with (*a*) an ordinary milk formula; (*b*) a concentrated milk cereal (organ somewhat smaller in size and air bubble, no striking difference in form); (*c*) a very thick feeding, showing a marked decrease in size, form and air bubble, and not extending beyond the midline.

monogram, however, Meyer and Nassau [6] do speak of the "peristolische reflex," which may be excited by thick, concentrated feedings. But this remains the only definite recognition of a stomach function, the existence of which has not been demonstrated, proved or discussed.

4. Theile, P.: Zur Radiologie des Säuglings Magens, Ztschr. f. Kinderh. **15**:152, 1916.

5. Flesch and Péteri: Magenuntersuchungen mittels Röntgenstrahlen im Säuglingsalter, Ztschr. f. Kinderh. **2**:263, 1911.

6. Meyer, L. F., and Nassau, E.: Die Ernährungsstörungen im Säuglingsalter, Halle, Carl Marhold, Verlagsbuchhandlung, 1923, p. 41.

PROCEDURE

In order to establish definitely the existence of a peristolic function of the stomach, it was necessary to obtain photographic evidence, if possible. Since the peristolic reflex is only demonstrable by the effect of very thick foods on the stomach outline as contrasted with the effect of thin feedings, we made three sets of examinations on each of a series of infants, using three types of food, representing three degrees of consistency or thickness. These were (*a*) an average fluid formula, to which the child had become accustomed, generally one-half or two-thirds milk, etc.; (*b*) a concentrated, fluid formula of moderate thickness, and (*c*) a concentrated feeding of semisolid consistency, either mashed

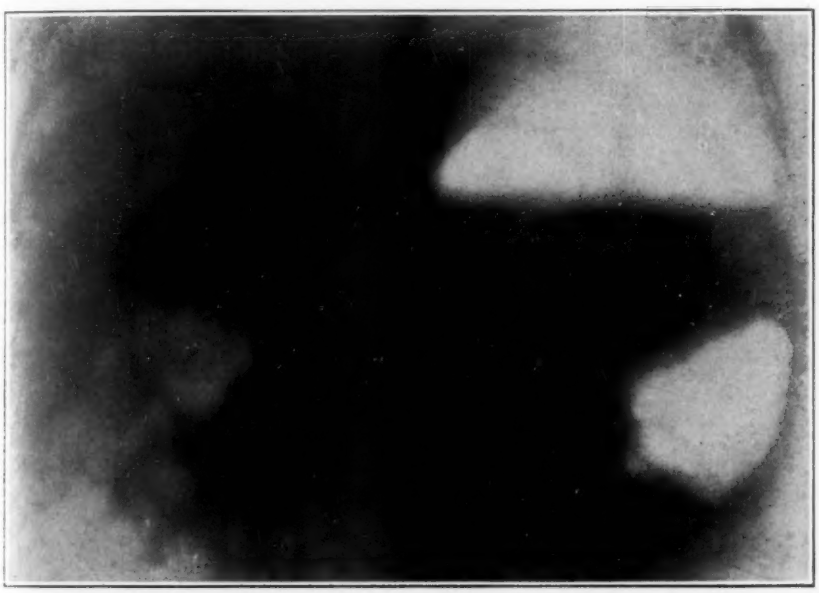

Fig. 2.—Stomach roentgenogram of a child, aged 10 months, after 100 gm. of Moro milk.

potato or vegetable or a cereal gruel. These last feedings were made so thick as to cling to the suspended spoon. Since a cereal or mush made with milk, however thick before ingestion, lost its semisolid consistency and became fluid in the stomach, thus failing to elicit the peristolic reflex as markedly as gruels prepared with water we used water in preparing our very thick foods.

In each case a fluoroscopic examination was made from three to four hours after the last meal, to insure an empty stomach. A second examination was made immediately after complete ingestion and followed at once by a roentgen-ray photograph.

The arrangement of the apparatus was just as described in the earlier paper [1] on stomach function. The child was placed in position before a canvas, which stood at a fixed distance from the camera. The plate was held in contact with, but not pressing on, the child's abdomen.

No contrast mediums were used, since satisfactory roentgenograms were obtainable without the aid of these salts.

OBSERVATIONS

It will be remembered from the foregoing paper of this series that we observed but two distinct types of infant stomach with fluid feedings; namely, the pear-shaped and the oval, both horizontal and extending beyond the midline.

Fig. 3.—Showing the same stomach as in Figure 2, after 100 gm. of a vegetable mush, a vivid illustration of peristolic function.

When we used a food of thick consistency, whether cereal, mashed potato or vegetable, it was possible to elicit the peristolic reflex and obtain pictures thereof. With gruels of moderate thickness there was only a slight response. Under the influence of very thick feedings both types of stomach contracted down strikingly and the form observed was a small, circular or oval outline, with hardly any or often no air bubble at all, which never extended beyond the midline, and commonly not as far.

Figure 1 shows a diagrammatic representation of the typical stomach with (*a*) ordinary milk concentrations; (*b*) with concentrated gruels of

moderate thickness, resulting in a somewhat smaller outline and decreased air bubble, and (*c*) the very small, circular form, which appears after feeding very thick gruels.

The effect of thick foods on the size, form and air bubble of the stomach is further illustrated and confirmed by a series of roentgenograms which we made on various cases, two of which series are shown in Figures 2, 3, 4 and 5 respectively.

Figure 2 shows the stomach roentgenogram of an infant, aged 10 months, that weighed 14 pounds (6.4 kg.) after 100 gm. of Moro milk (whole milk with 3 per cent. butter, 4 per cent. flour and 6 per cent. sucrose). The pear shaped outline, typical with fluid feedings, can be

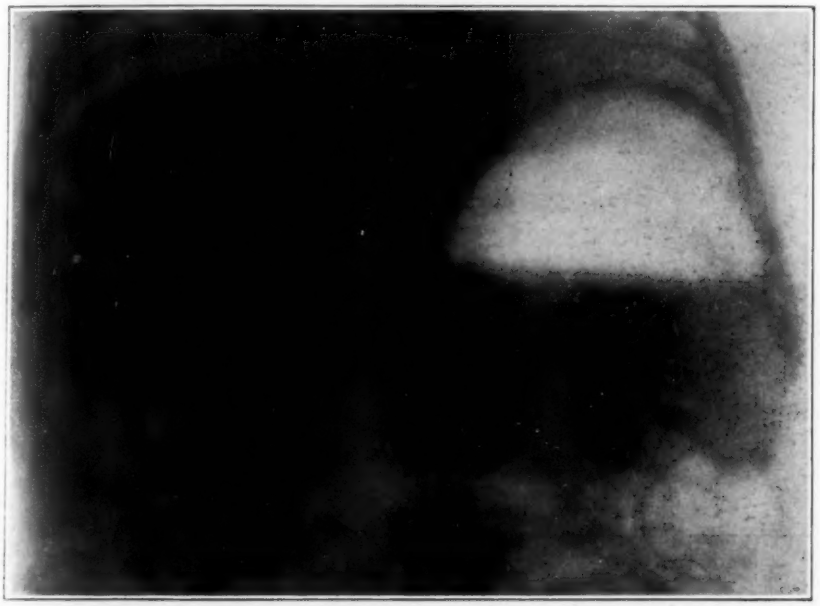

Fig. 4.—Stomach of a child, aged 9½ months, with 100 gm. of Moro milk. "S. F.," stomach fold.

traced beyond the midline to the right. The air bubble takes up about one-third the stomach content.

Figure 3 shows the same stomach following 100 gm. of a thick, vegetable mush. The organ is strikingly smaller, circular in shape and does not extend beyond the midline. The air bubble is almost negligible in size.

Figure 4 shows the stomach of a child, aged 9½ months, that weighed 11 pounds (5.0 kg.) after a fluid feeding of 100 gm. Moro milk. The organ appears pear shaped, rather large, extending to a point more than half way between the vertebral column and the right abdominal wall.

The air bubble includes almost half the stomach area. The vertical stomach fold (S. F.), due to the rounded, expanded fundus, is distinctly visible.

This same stomach, after 100 gm. of a mixed vegetable and potato mush, appears as Figure 5. Gas in the intestines interfered with a perfect picture. However, it is clear that, under the influence of a thick feeding, this enormous stomach had contracted down to a much smaller, circular form, barely extending to the midline. The air bubble is also much smaller.

Fig. 5.—Same stomach as in Figure 4, after 100 gm. of a mixed vegetable and potato mush. The organ appears circular, and much smaller than after fluids. The air bubble is also decreased and the outline does not extend beyond the midline.

These pictures, as well as others we have taken, demonstrate the existence of the peristolic function in the infant stomach very definitely. This power of the gastric organ to surround and grasp thick foods is more than a mere theoretical consideration. The peristolic reflex has a profound, practical significance in the treatment of cases of pylorospasm and habitual vomiting.

SUMMARY

There is a divergence of opinion concerning a peristolic function of the stomach in infants, some authors affirming and others denying its existence.

The peristolic function is not to be confused with the more familiar peristaltic function, and may be defined as that capacity of the stomach wall to surround or grasp its contents following the ingestion of food.

It is the purpose of this paper to prove the existence of a peristolic function in the stomachs of infants.

Procedure.—Fluoroscope examinations were made immediately before and after each meal. Roentgenograms were made at the end of each feeding. The feedings used were (*a*) an average milk formula of fluid consistency; (*b*) a concentrated gruel of moderate thickness, and (*c*) a very thick food of cereal and water or mashed potato and vegetables.

CONCLUSIONS

The infant stomach exhibits a so-called "peristolic function," the actual existence of which may be demonstrated by roentgenographic exposures (Figures 2, 3, 4 and 5).

The infant stomach reacts differently to fluids and to semisolids, as follows: (*a*) with fluids the stomach assumes either a pear or oval shape, horizontal in position and extending to or beyond the midline, the air bubble being large or moderate in size; (*b*) with foods of very thick consistency the baby's gastric organ contracts down to a small, circular or oval shape, barely reaching the midline, never extending beyond, and with a very small air bubble, or often none at all.

The peristolic reflex has an important, practical significance in the treatment of pylorospasm and habitual vomiting.

ACUTE APPENDICITIS AND PNEUMONIA IN A BABY FOURTEEN MONTHS OF AGE*

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AND
J. LOUIS RANSOHOFF, M.D.
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L. S., a girl, aged 14 months, was admitted to the Jewish Hospital, Feb. 17, 1924, with the complaint of fecal fistula, and recurrent attacks of fever, following the drainage of an appendix abscess, on Sept. 3, 1923.

History of Previous Illness.—The child was admitted to the Pediatric Service of the Cincinnati General Hospital on Aug. 28, 1923, with the complaint of distention of the abdomen. At the time of admittance the child had a history of whooping cough four months previously. In fact, she was still coughing, but not whooping. The present attack apparently started six days previously with diarrhea, the child passing eight greenish watery stools in the first twenty-four hours. The diarrhea was controlled in two days, but the following day, the day before admission, the child suddenly developed fever and showed distention of the abdomen. The physician who saw the patient at her home made a diagnosis of pneumonia, and referred her to the hospital, where she came under the care of one of us (G).

Past History.—She was breast fed for ten months and was never sick.

Family History.—Negative.

Physical Examination.—On admission, the child appeared to be very sick and markedly prostrated. The temperature was 103. The pulse, 170. Respiration, 50. Except for the chest and abdomen the patient was normal.

Chest.—Impaired resonance at the left base with showers of fine crepitant râles here and in the left axilla. An occasional râle was heard at the right base posteriorly, which was clear on percussion.

Abdomen.—Markedly distended, about 3 cm. above the chest level. There was definite general rigidity, more marked in the right lower quadrant, with some tenderness. The percussion note was tympanic anteriorly, obliterating some of the liver dulness. There was, however, some dulness in the flanks, but no fluid wave could be elicited.

The white blood count on admission was 35,000.

Tentative Diagnosis.—Bronchopneumonia and an acute abdominal condition, most likely acute appendicitis. The surgeon whom we called in consultation stated that in his opinion the bronchopneumonia which was present was sufficient to account for the abdominal symptoms.

The temperature continued elevated and the distension of the abdomen became more marked.

The white count on September 2, was 44,700, and on September 3, was 49,500.

The urine examination was negative, except for acetone. On the fifth day after admission a definite mass could be palpated in the right lower quadrant. The chest examination still showed some scattered râles in both sides of the chest, but roentgen-ray examination of the lungs showed only a mottling in both hilum regions. The signs in the abdomen definitely pointed to an appendix abscess, which had developed in the right iliac fossa. It was decided to open the abdomen under local anesthesia in spite of the poor general condition of the child.

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* Received for publication, April 29, 1924.

* From the Pediatric Service of the Jewish Hospital.

Procedure.—Under local anesthesia operation for the drainage of an appendiceal abscess was performed. A short McBurney incision was made. When the internal oblique had been reflected a quantity of edema was seen in the peritoneum and extra peritoneal tissues. Palpation showed there was a small mass which was adherent to the peritoneum. On opening the peritoneum there was an escape of 3 ounces (93 gm.) of foul colon bacillus pus. A short search was made in the abscess, but it was deemed wisest to drain the abscess and look for the appendix later. Three cigarette drains were inserted, one toward the kidney, one down the cecum, and one down the pelvis. As the whole process was well localized, the patient's prognosis should have been good.

Postoperative diagnosis: Appendicitis, acute, with abscess.

The child, after a stormy convalescence for a few days, made an uneventful recovery, and on September 27, was discharged in good condition, with the wound entirely healed.

On admission to the Jewish Hospital, Feb. 17, 1924, the mother stated that the child had been ill for one or two days of each week since her discharge from the Cincinnati General Hospital the previous September. She also stated that the child had a poor appetite, was markedly constipated, and occasionally was feverish. Most of these symptoms, but especially the fever, were relieved by the discharge of pus from the wound on several occasions. At one time the physician on the case reported that a small bit of fecal material was discharged from the wound.

Physical Examination.—The child was small, pale and markedly undernourished. The abdomen presented fulness in the right lower quadrant, with an old appendectomy scar, from which seropurulent material was draining. The rest of the physical examination was essentially negative. The general condition, however, warranted an operation, which was performed by one of us (R.) on February 22.

Operative Record.—Preoperative diagnosis: fecal fistula, chronic appendicitis.

Postoperative diagnosis: The same.

A skin incision was made, surrounding the fistula, and the abdomen was opened through the right pararectal incision. The fecal fistula was found communicating with the last coil of ileum, which was adherent to the abdominal wall. The adherent intestine was dissected loose and the fistula closed with Lembert sutures.

The appendix was found retrocecal and adherent to the parietal peritoneum. There was a sharp constriction in the middle and the end was bulbous. It was removed in the usual way, with inversion of the stump.

The abdomen was closed in the usual way, with a counter drain through the site of the old fistula.

Postoperative condition: there was some shock. The patient's recovery was uneventful, except for a slight wound infection.

The child was dismissed from the hospital on March 18 with the wound well healed, and in excellent condition, having gained 1½ pounds (0.7 kg.) since the operation.

COMMENT

This case presents three interesting points. First, it is most unusual to find an acute appendicitis with subsequent abscess formation in a child aged 14 months. Secondly, it is the first recorded case to our knowledge, of a child of this age, with acute appendicitis obscured by pneumonia. Adams and Berger [1] studied a series of 145 cases of lobar pneumonia in children aged from 2 to 15 years, and found that 17.5

1. Adams, F. D., and Berger, B. J.: Differential Diagnosis of Lobar Pneumonia and Appendicitis in Children, J. A. M. A. **79**:1809 (Nov. 25) 1922.

per cent. had been wrongly diagnosed as acute appendicitis or surgical condition of the abdomen. They further state that they had never seen appendicitis wrongly diagnosed as pneumonia, and studied a series of sixty-three cases with acute appendicitis with or without abscess or peritonitis. This case, nevertheless, emphasizes the necessity of considering the presence of appendicitis in children showing marked abdominal signs, even though there is pneumonia present.

The third point of interest in the case is the type of fecal fistula coming from a loop of a small intestine adherent to the anterior abdominal wall, which is an unusual complication in childhood.

RESPIRATORY DISEASES IN CHILDREN: A REVIEW OF THE LITERATURE FROM JULY, 1921, TO JULY, 1923 *

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The thorax of the stillborn, of the new-born, and of normal infants has been studied roentgenologically by various authors. Evans [1] found that the lung in fetal life is completely atelectatic, and fills the thorax. In the stillborn, the shape of the chest and the abdomen is ovoid, the lower ribs flaring to accommodate themselves to the wide upper abdomen. The upper pole of the thoracic cage is distinctly narrowed, the ribs are sloping, and there is an even density throughout the areas of the lung, the shadow of the heart not being distinguished from lung tissue. After respiration, the ribs are elevated and lie at right angles to the spine, and the upper thoracic cage is definitely increased in diameter. Evans had a series of plates taken after the lungs had been insufflated by means of a gas machine. In all cases he found gaseous distention of the stomach and intestines, but no change in the lungs. Experimental insufflation of the lungs of stillborn infants by means of a catheter passed into the trachea demonstrated that it is impossible to inflate the lungs by air pressure, because of early rupture with the escape of air into the pleural cavities, usually a pressure equal to 10 mm. of mercury being the limit of safety. The thymus was enlarged in cases of faulty respiration, and was believed to be a definite factor in asphyxia neonatorum.

DeBuys and Samuel [2] studied fifty-two new-born infants within the first forty-eight hours of life. They concluded that the shadows of the heart and thymus vary in shape, size, and position, and that these variations bear no relationship to the size of the infant. There is no constant relationship between the heart shadows and that of the thymus, and the thymus shadow is not necessarily influenced by the position of the heart. These variations in the shadows of the heart and thymus can exist without clinical manifestations of disease.

Austrian, Landis and Blackfan,[3] in their report to the National Tuberculosis Association, discussed the clinical findings in the normal

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1. Evans, W. A.: Roentgen Ray Studies of the Thoraces of the Stillborn and New-Born, Am. J. Roentgenol. **9**:613-617 (Oct.) 1922.

2. DeBuys, L. R., and Samuel, E. C.: A Study of the Shadows in the Thorax of the Newly-Born, Am. J. Dis. Child. **24**:397-403 (Nov.) 1922.

3. Austrian, C. R.; Landis, H. R. M.; Blackfan, K. D.; Pancoast, H. K.; Dunham, K., and Baetjer, F. H.: X-Ray and Clinical Findings in Normal Chest of the Child, Am. J. Roentgenol. **9**:537-543, 1922.

chest, and the reader is referred to their report, for it would lose its value if further condensed.

Pancoast, Dunham and Baetjer [3] found that the normal chest is subject to wide variations, roentgenologically. The conglomerate shadow commonly called the hilum shadow, when found lying entirely within the inner third of the area of the lung, can be regarded as normal, except when it is made up of a solid mass of homogeneous shadow, undoubted evidence that it represents a growth or mediastinal pleurisy. Calcified nodes at the roots of the lungs, without indication of disease, are of no significance except as possible evidence of a healed inflammatory lesion, possibly, but not necessarily, tuberculous. Such nodes are a common finding in normal chests; in the normal lungs, the shadows of the bronchial trunk are not visible in the extreme apical region. The chest is divided into three vertical areas: the inner zone contains the root shadows, the median zone the trunk shadows, which gradually fade out into their final subdivisions, while the peripheral zone contains radiating lines from these, which disappear before the periphery is reached. If, in the median zone or peripheral zone, these shadows do not disappear in the characteristic manner, they may be evidence of a variety of lesions, inflammatory or otherwise, past or present. They may accompany a tuberculous process, but not necessarily be indicative of tuberculosis. Until corroborated by laboratory or clinical findings, the use of the terms "active" or "quiescent" should not be definitely applied to evident lesions demonstrated on plates.

Paton and Rowand [4] studied twelve normal infants, aged from 8 days to 15 weeks. Their conclusions are essentially the same as the foregoing. There is definite shadowing, not homogeneous, extending from the fifth to the eighth ribs, bounded externally by a semilunar line extending outward. At the level of the sixth or seventh rib, this occupies nearly three-sevenths of the total distance from the median line to the circumference. This area contains the root of the lung. In all cases there are varying degrees of linear shadows, sometimes definitely arborescent, and radiating from this area; they are probably shadows of tissues of the normal bronchial tree. It is not known whether or not other structures, such as blood vessels, are included. The authors also agree that the size, position and shape of the heart shadow in healthy infants show wide variations.

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4. Paton, J. H. P., and Rowand, A.: The Normal Infant's Chest. A Preliminary Report on the X-Ray Examination of the Chests of Healthy Infants, Lancet **2**:201-804 (Oct. 14) 1922.

UPPER RESPIRATORY INFECTIONS

Lemere,[5] in discussing sinus disease in children, enumerated a number of the symptoms which may be present and which warrant an investigation of the accessory nasal sinuses, such as profuse nasal or postnasal discharge, cough, persistent mouth breathing after the removal of tonsils and adenoids, pale face and lips, running ear, otitis externa, mastoiditis, poor appetite, recurring bronchitis, pneumonia, asthma, pleuritis, headaches, mental hebetude, chorea, nervousness, arthritis, chronic pharyngitis, facial acne, conjunctivitis, keratitis and cervical adenitis. The diagnosis may be made from (1) discharge, (2) signs of general toxemia, (3) roentgenogram, (4) puncture and irrigation and (5) condition of the pharynx posterior to the tonsils. He advocates the use of the postnasal spray with a modification of a compound solution of sodium borate (Dobell's solution) to clear out the discharge. This treatment will often eradicate the infection in children under 8 years. Over this age it is mainly supportive of normal development until the child is old enough for a drainage operation. Chronic involvement of the sinuses always originates from lack of complete resolution of an acute infectious disease. Lemere advises, therefore, greater care at this time. Removal of tonsils and adenoids may help.

Brennemann [6] directs attention to the symptom of abdominal pain in association with throat infections, and by throat infections he means the whole series of upper respiratory tract infections that grade imperceptibly from the common cold to the fatal septicemia beginning in the throat. The pain is referred to the umbilicus and varies in intensity. It may be very slight, or the child may cry with the pain for hours. It may be intermittent and sometimes lasts weeks and months after all other symptoms have subsided. It is due, perhaps, to enlargement of the mesenteric and retroperitoneal lymph nodes and is often diagnosed as appendicitis. On the other hand, one must always be on guard not to miss a case of true appendicitis.

ASTHMA

Herman [7] made a clinical study of sixty-one cases of asthma and eczema in infancy and childhood, controlled by cutaneous and protein sensitization tests. Egg protein, rabbit hair, cow's milk (especially the lactalbumen portion), mustard, lamb's wool, and chicken, goose and duck feathers, gave the most frequent positive reactions. Fourteen of thirty-

5. Lemere, H. B.: The Treatment of Accessory Nasal Sinus Disease in Children, Am. J. Dis. Child. **24**:520-525 (Dec.) 1922.

6. Brennemann, Joseph: The Abdominal Pain of Throat Infections, Am. J. Dis. Child. **22**:493-499 (Nov.) 1921.

7. Herman, Harold: A Clinical Study of Sixty-One Cases of Asthma and Eczema in Infancy and Childhood Controlled by Cutaneous Protein Sensitization Tests, Am. J. Dis. Child. **24**:221-238 (Sept.) 1922.

one patients with asthma, and thirteen of thirty with eczema did not reveal hypersensitiveness of skin tests. None was found sensitive to bacteria. Herman emphasizes the importance of focal infections as an etiologic factor in these children.

Ratner [8] reported six cases of rabbit hair asthma in children. Eczema, vomiting, angioneurotic edema, urticaria and conjunctivitis as well as asthma occur from contact with this hair. Its distribution is widespread and it should be placed second to horsehair as a causative agent in the keratin group of asthma. It is found in felt, pillows, mattresses, toys and clothing. Ratner was unable to desensitize patients successfully.

Larsen and Bell [9] also emphasize the importance of rabbit hair as a causative agent in asthma. Of 100 patients with asthma and chronic bronchitis, forty-four were sensitive to protein. Of the latter, thirty-six were sensitive to animal emanations, and of the thirty-six, thirty-two reacted to rabbit hair. In the sensitive group, removal of the protein from the environment gave marked immediate relief, while in the others, simple hygienic measures gave relief in slightly more than half the cases.

Cunningham [10] found that in sixteen of thirty-eight patients, the symptoms of asthma began in infancy. Eleven patients reacted to proteins, in only six of whom, however, did the symptoms disappear when that protein was withheld. His treatment consisted of avoidance of the offending protein, and immunization by injection or by mouth. He used an autogenous vaccine in twenty patients, with cure or marked improvement in seven (35 per cent.). Patients with asthmatic bronchitis due to bacteria, if unimproved by intensive use of vaccine, may be greatly benefited or permanently cured by change of climate, temporary or permanent. The improvement, however, may not be immediate. There is another group consisting of those who have asthmatic symptoms from miscellaneous causes, such as myocardial weakness, neuroses, and infected tonsils and sinuses.

Henske [11] injected autogenous defibrinated blood from every four to five days until from seven to ten injections had been given. Permanent relief was obtained in 56 per cent. of cases, temporary relief in 25 per cent. and no benefit in 19 per cent.

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8. Ratner, Bret: Rabbit Hair Asthma in Children, Am. J. Dis. Child. **24**: 346-355 (Oct.) 1922.

9. Larsen, N. P., and Bell, S. D.: Classification and Management of Asthma in Childhood. The Importance of Rabbit Hair as a Cause in New York City, Am. J. Dis. Child. **24**:441-449 (Nov.) 1922.

10. Cunningham, A. R.: Treatment of Asthma and Associated Diseases in Children, Boston M. & S. J. **186**:876-877 (June 29) 1922.

11. Henske, A. C.: The Treatment of Bronchial Asthma with Autogenous Defibrinated Blood, J. Missouri M. A. **18**:431-435 (Dec.) 1921.

Fordyce [12] emphasizes the nervous system as a factor in asthma. The phenomena of an asthmatic attack results from the discharge of energy from the bronchial center in the medulla, this discharge being stimulated by excitants of an anaphylactic, reflex or psychical nature, or by a combination of these. Experimentally, general anesthesia prevents development of anaphylactic phenomena. In asthma we have to deal with the autonomic or vegetative nervous system, and more especially with the parasympathetic. It is closely associated with the functional activity of the autonomic nervous system and the endocrine glands. Other factors are also discussed.

NONTUBERCULOUS BRONCHIAL LYMPHADENOPATHY

Fleischner [13] believes that simple lymphadenitis, acute, subacute, or chronic, is a distinct clinical entity. It may be divided into five definite types, based on the clinical history and cardinal symptoms, (1) malnutritional, (2) subacute bronchitis, (3) pertussoid, (4) chronic febrile and (5) asthmatic. When one considers the great incidence of respiratory infections to which bronchial lymphadenitis is secondary, the general conclusion can be reached that this type of disease, in contrast to tuberculosis, is the most common of the bronchial lymph nodes. The diagnosis is made by a combined consideration of the history, physical signs and interpretation of the roentgen ray. The physical signs include the presence of D'Espine's sign, dulness, with prolonged and harsher sounds on expiration in the interscapular region, dulness in the superior sternal regions, including the sternoclavicular articulations, and dulness to the right and left of the sternum between the clavicle above and the third rib below. Roentgen-ray examination is of less value. The condition must be differentiated from tuberculosis, and this depends on the use of tuberculin. The treatment may be summarized briefly under rest, fresh air and diet. The prognosis is invariably good, unless there is a secondary infection by the tuberculosis bacillus.

INFLUENZA

Meyer [14] says that influenza in young children is manifested as a general infection. The great difference in the course of the disease, varying from a mild form with rapid recovery, to a severe and fatal form, suggested to him the question of the factors which determine the course of this infection, such as the nature and virulence of the

12. Fordyce, A. D.: Asthma in Childhood, Lancet **1**:175-178 (Jan. 27) 1923.
13. Fleischner, E. C.: Bronchial Lymphadenopathy, Nontuberculous, J. A. M. A. **79**:175-180 (July 15) 1922.
14. Meyer, L. F.: Praktische Ergebnisse. Empfänglichkeit und Resistenz junger Kinder gegenüber Grippalen Erkrankungen, Klin. Wchnschr. **1**:737-741 (April 8) 1922.

causative agent and the degree of immunity already present. Among the external factors which increase susceptibility, the greatest importance has been attributed to cold. During the first 6 months of life the child is more susceptible to gastro-intestinal disease and less susceptible to respiratory catarrh than after that age. A number of acute and chronic infectious diseases, such as measles, pertussis, tuberculosis and syphilis, are known to increase the susceptibility. Such congenital anomaly of constitution as the exudative diathesis, also is a predisposing factor. The neuropathic constitution has certain effects on grip, for with high fever, irritative symptoms in the central nervous system may be present. Nutrition is an important factor in natural resistance. Even slight disturbances in nutrition cause a decrease in resistance. Experimentally it has been shown that foods rich in fat or albumin increase the resistance to tuberculosis, while carbohydrates decrease it. The need for prophylaxis is emphasized, for the danger of respiratory diseases can, and must, be lessened, and immunity and resistance can be increased in the "sickness-free" days.

Suzuki [15] cared for 1,560 children with influenza in Dairen, Manchuria, 503 of whom were under 1 year of age. One hundred forty-four (9 per cent.) died, and eighteen necropsies were performed, the pneumococcus being isolated in all. The sputum was examined in 172 cases and the pneumococcus found in 120. Bacteriologic examination in all complications, such as otitis media, yielded pneumococcus in pure culture. Suzuki concluded, therefore, that this organism is the cause of influenza. The question arose as to whether pneumonia itself was not a complication. The object of his study was to find out whether it was a complication, and if so, when it commenced and what was its incidence. The appearance of physical and general signs is noticed on the sixth day of fever (third to tenth), while on the second day of fever the roentgenogram reveals a shadow of a pneumonic process. The grip pneumonia, therefore, exists at the beginning of the disease, but cannot be diagnosed until the sixth day (average) by ordinary procedures. At first, the radioscopic shadow is light, but with the appearance of physical and general symptoms it becomes more intense. Those cases are divided, according to degree of intensity, into three groups: (1) those in which a triangular shadow involves the right lower lobe (31 per cent.); (2) x-shaped shadows in which the region of the hilum is involved (62 per cent.), and (3) shadows of the upper lobes (7 per cent.). Roentgen-ray investigation of influenza patients without symptoms referred to the chest, and those with gastro-intestinal or meningeal symptoms, revealed shadows in most cases. The

15. Suzuki, T.: L'influenza chez les enfants principalement chez les nourrissons, Arch. de méd. d. enf. **25**:193-214, and 268-294 (April) 1922.

author concluded, therefore, that pneumonia is not a complication of influenza, but is the disease itself, and influenza is pneumonia in an epidemic state.

Zschocke [16] observed forty-one patients with influenza, thirteen of whom developed laryngitis leading to stenosis. Two of these had diphtheria also and are, therefore, not included in the study. Of the remaining patients, three had a mild type of the disease, and recovered, but the others died. All the patients in whom constriction developed before the fourth day died. The treatment consists of inhalations, sedatives and cardiac stimulants. Zschocke no longer performs intubation, because of the mechanical trauma to the mucous membrane and because it gives little hope of relief.

Siegmund [16] studied these cases from the pathologic standpoint, and says that tissue necrosis predominates throughout, beginning in the epithelium and extending even to the musculature and cartilage. He believes these phenomena are the manifestation of uninhibited toxic action. The anatomic position and structure of the larynx and its function in removing masses of secretion may furnish an important predisposing factor for the localization of the changes.

Belbèze [17] used intramuscular injections of 1 c.c. purified turpentine empirically in infants and 1.5 c.c. in older children. It has an almost immediate effect on the temperature.

PNEUMONIA

Browne [18] found that twenty-one of a series of eighty infants died from pneumonia, and he estimated that the premature infant is about fourteen times as liable to die from pneumonia as the infant born at full term. The pneumonia is sometimes due to antenatal infection from premature rupture of the membranes, the infant not only being infected, but suffering from an advanced stage of the disease before its birth, for the infant has little defensive reaction. Pneumonia in the first few days of life is an extremely insidious disease, and generally does not present characteristic symptoms which might lead to its detection. In only one case of this series was a tentative diagnosis of pneumonia made. "Acute hemorrhagic pneumonia of infants" forms a distinct clinical and pathologic entity, which causes sudden death in children, whether full term or premature, who may have been healthy previously. It follows acute congestion of the lungs, the fragile vessels

16. Zschocke, O., and Siegmund, H.: Ueber Influenzakrupp des Kindes, Jahrb. f. Kinderh. **100**:15-33 (Nov.) 1922.

17. Belbèze, R.: Traitement de la grippe infantile par le terébénthine injectable (Collobiase), Lyon méd. **131**:526-531, 1922.

18. Browne, F. J.: Pneumonia Neonatorum, Brit. M. J. **1**:469-471 (March 25) 1922.

in the alveolar walls rupturing and flooding the alveoli and bronchi with blood. The sudden death is preceded by epistaxis and blanching of the skin. The etiologic factor may be organismal or possibly of the nature of an immediate anaphylactic reaction. Browne emphasizes the importance of avoiding premature rupture of the membranes during labor and of taking every precaution to safeguard the new-born infant against infection.

Nobel [19] and Dabowsky [20] discussed the diagnosis of asthenic pneumonia in premature and feeble infants, and reported twenty cases. This condition is often atypical, and the symptoms are seldom classical. Often the clinical symptoms may not run parallel with the roentgen-ray findings. The roentgenogram may be negative in the presence of positive clinical findings, and at necropsy the process may be more extensive than the clinical or roentgen-ray findings indicate. Loss of appetite, or loss of weight, a grayish color of the skin, bile and blood in the vomitus, meningeal signs, cyanosis and dyspnea, are significant. The meningeal signs often result in a wrong diagnosis. Pneumonia may be found at necropsy in cases diagnosed as debility. The mother and infant should occupy separate rooms to lessen the danger of carrying infection.

Mouriquand and Ravault [21] divided the meningeal syndromes seen in the course of pneumonia into three groups: (1) purulent meningitis; (2) serous meningitis, in which the cerebrospinal fluid is clear but may be under pressure, and lymphocytosis, polynucleosis and pneumococci may be present, and (3) meningeal states in which the fluid is absolutely normal, so-called meningism. They reported two cases presenting symptoms of meningitis. The spinal puncture, however, was negative. The roentgenogram and the subsequent course proved that the patient had pneumonia.

Lyon [22] made a bacteriologic study of ninety-eight cases of lobar pneumonia, fifty-two of bronchopneumonia, and fifteen of postpneumonic empyema in patients aged 12 years or younger. In cases of lobar pneumonia, or of empyema following it, he isolated pneumococcus, Type 1, in 29.9 per cent.; Type 2, in 3 per cent.; Type 3, in 7.1 per cent., and Type 4 in in 37.7 per cent. There is a reasonably

19. Nobel, E.: Beitrag zur Klinik der asthenischen Pneumonie der Saüglinge, Wien. klin. Wchnschr. **35**:79-81 (Jan. 26) 1922.

20. Nobel, E., and Dabowsky, N.: Beitrag zur Diagnose der asthenischen Pneumonie der Frühgeborenen und lebenschwachen Säuglinge, Ztschr. f. Kinderh. **31**:188-207 (Dec.) 1921.

21. Mouriquand, G., and Ravault, P.: Le meningisme dans la pneumonie infantile, Lyon méd. **132**:3-7 (Jan. 10) 1923.

22. Lyon, A. B.: Bacteriologic Studies of One Hundred and Sixty-Five Cases of Pneumonia and Postpneumonic Empyema in Infants and Children, Am. J. Dis. Child. **23**:72-87 (Jan.) 1922.

close relationship to the findings in a parallel series of cases in adults. Studies of the comparative mortality suggest that the child possesses a better natural immunity against the pneumococcus, type for type, than the average adult. In bronchopneumonia the fixed types of pneumococcus are much less common than in lobar pneumonia and, regardless of type, the general mortality is much greater than in lobar pneumonia. *Streptococcus hemolyticus* and *Staphylococcus aureus* were common in bronchopneumonia and were followed by a particularly high mortality. There was an extraordinary tendency to the development of empyema, due to pneumococcus Type 1. Nearly 38 per cent. of patients with pneumonia caused by this organism developed this complication, and it outranked any other cause of empyema in this series by about six to one.

Popper [23] demonstrated that the sequence of the development of physical signs in lobar pneumonia is relative dulness, gradually increasing in extent and intensity, followed by diminished breathing with or without crepitant râles, and finally bronchial breathing. He emphasizes the importance of percussion in the early diagnosis of lobar pneumonia in children.

In a study of 3,080 cases of measles, Mixsell and Giddings [24] found that pneumonia had developed in 26.8 per cent. of the patients, and of these 51.3 per cent. died. Eighty-nine and two-tenths per cent. of all of the deaths were due to pneumonia, the highest mortality occurring in children aged from 7 months to 2 years (72.6 per cent. of all deaths). There were 2.56 per cent. of deaths from empyema and less than 1 per cent. from tuberculosis. These authors advocate the prevention of overcrowding, and the inauguration of more intensive nursing care. If possible, such patients should be treated at home, rather than in hospitals.

Adams and Berger [25] wrote an interesting article on the differential diagnosis of lobar pneumonia and appendicitis. They studied 145 cases of lobar pneumonia in patients from 2 to 15 years of age, and sixty-three with proved appendicitis. In 17.5 per cent. of cases of pneumonia, acute appendicitis, or some surgical condition in the abdomen, had been diagnosed, and in 4.8 per cent. cerebrospinal meningitis. A history of cough or pain in the chest indicates pneumonia, but the absence of respiratory symptoms does not rule out this disease. A history of vomiting, abdominal pain and diarrhea is of no value, as

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23. Popper, J.: The Value of Percussion in the Early Diagnosis of Lobar Pneumonia in Children, New York M. J. **117**:266-267 (March 7) 1923.

24. Mixsell, H. R., and Giddings, E.: A Report of 3,080 Cases of Measles with Special Reference to Pneumonia, South. M. J. **16**:90-94 (Feb.) 1923.

25. Adams, F. D., and Berger, B. J.: Differential Diagnosis of Lobar Pneumonia and Appendicitis in Children, J. A. M. A. **79**:1809-1814 (Nov. 25) 1922.

these symptoms are as common with pneumonia as with abdominal disorders. The patient suffering from pneumonia always seems more ill, and presents a characteristic general picture not seen in the abdominal cases. If recognized, this is a very important differential point. The systemic reaction is more severe as seen by the pulse and the temperature chart, than in the abdominal cases. Careful examination of the lungs may reveal a small area suggesting early consolidation, but if it is located in the upper half of the chest, or if the patient does not otherwise present the picture of pneumonia, it must be interpreted with caution. Abdominal tenderness and spasm are relatively common with pneumonia, but are dissimiliar to the types found in acute abdominal conditions. A high leukocyte count is suggestive of pneumonia except when peritonitis or appendiceal abscess is suspected, in which case it is of no value in differentiation. In the presence of symptoms or signs of meningeal irritation, lobar pneumonia should be ruled out before lumbar puncture is performed.

According to Weill and Dufourt,[26] the roentgenogram usually reveals a triangular shadow in cases of pneumonia in children. It varies in intensity and in the time of its appearance. Usually the earlier the appearance the more severe is the infection. The base is most often in the axillary line, but in cases of so-called central pneumonia, it rests on the pleura in the interlobar fissure and is therefore cortical and peripheral anatomically, if not roentgenologically. There are usually three phases. At first there is only a triangular shadow which disappears later, owing to the presence of other shadows, the result of congestion in the surrounding tissues, and finally reappearing during defervescence. The authors describe other transverse bands which vary in thickness, and which may be due to tuberculous infection of the mediastinal, interpulmonary and intrapulmonary lymph nodes, extending even to the lung itself. Other linear shadows may be due to interlobar fibrosis or pleuritis; the hepatised area is silent and the auscultatory signs arise from congestion in the neighborhood of the pulmonic focus. A pneumonic process clinically demonstrable by auscultation casts only slight or insignificant shadows, while a pneumonic process clinically mute, usually, if not always, appears in the form of a triangle with sharp contour.

In the paper by Weill and Gardère [27] a few additional points are given. The right upper lobe is involved in more than 50 per cent. of cases. Pneumonia of the apex exists but is rare, and can be differenti-

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26. Weill, E., and Dufourt, A.: Sur quelques points de radiologie concernant les affections pleuro-pulmonaires de l'enfance, J. de radiol. et d'électrol. **6**:1-11 (Jan.) 1922.

27. Weill, E., and Gardère, C.: Considérations sur le diagnostic de la pneumonie du nourrisson, Paris méd. **13**:67-74 (Jan. 20) 1923.

ated only by roentgen-ray examination. The prognosis is grave. When the lower lobes are involved the triangular shadow is obscured by the interposition of abdominal shadows.

Lewis [28] calls attention to pericarditic pseudopneumonia. The signs of apparent consolidation (dulness, bronchial breathing and bronchophony) at the left scapular angle are, in all probability, due to compression of the pulmonary tissue either by the heart, the pericardium, or by both. These pulmonary signs seem to have little influence on the course of the disease, as the signs disappear with the improvement of the pericarditis. A common mistake in these cases is to assume that lobar pneumonia is present.

Nobécourt and Paraf [29] reported four cases in which the patients were admitted to the hospital with supposedly respiratory diseases, which were later proved to be typhoid or paratyphoid.

Engel [30] criticizes the term "paravertebral hypostatic pneumonia," applied by Bartenstein and Tada to the infiltration of the lungs of infants weakened through malnutrition. He wishes to change it to "paravertebral dyselectatic pneumonia," because the areas affected are not of necessity hypostatic, but may occur elsewhere when the aeration seems to be poor.

Thoenes [31] found, by roentgenoscopic methods, in cases of unilateral pneumonia in infants that the whole mediastinum, especially the heart, was displaced toward the affected side. This had been observed previously, although rarely in adults. Ordinarily it cannot be demonstrated by clinical methods. Return to the normal position after resolution of the pneumonia is very slow. At necropsy, atelectatic diminution in the volume of the diseased lung, with inflation of the healthy lung, was demonstrated. The author believes that the phenomenon is due to imperfect development of elastic fibers, which is characteristic of infancy, with the resultant tendency to atelectasis, and to the fact that the mediastinal wall is more flexible at this time of life.

Galbraith [32] presented a case report of a baby boy, aged 8 months, who died from septic bronchopneumonia with pneumococcus pyemia, and who had lesions of the skin closely resembling smallpox.

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28. Lewis, M. S.: "Pericarditic Pseudopneumonia" in Children, M. Rec. **101**: 327-329 (Feb. 25) 1922.

29. Nobécourt, P., and Paraf, J.: Les complications broncho-pulmonaires: des infections typhoidiques chez l'enfant, Paris méd. **47**:74-76 (Jan. 20) 1923.

30. Engel, S.: Die paravertebrale dystelektatische Pneumonia der Säuglinge, Arch. f. Kinderh. **71**:1-6 (Feb.) 1922.

31. Thoenes, F.: Ueber Medistinalverlagerung bei infiltrativen Lungenerkrankungen im Säuglingstalter, Monatschr. f. Kinderh. **23**:353-365 (July) 1922.

32. Galbraith, J. B. D.: Bronchopneumonia with Pyaemic Skin Manifestations Resembling Smallpox, Brit. M. J. **2**:526-527 (Oct. 1) 1921.

Foote [33] has discussed the infantile thorax of the rachitic child as a predisposing factor in bronchial infections. The ribs and sternum being made up of separate unossified pieces of cartilage, and the muscles being weak, the cough is feeble and the child cannot easily expel mucus. Any portion of the lungs, under these conditions, may easily collapse, either partly or wholly, if a bronchus should become plugged with inflammatory exudate or from any other cause. Foote refers to lowered bronchial resistance because of insufficient negative pressure in the pleura, with its tendency toward incomplete alveolar distention and the presence of bronchotetany or spasm of bronchial musculature resulting in retention of secretion in the terminal bronchi. A thoracoabdominal binder will help the expulsive efforts.

Besides the mild respiratory diseases of infancy, other rarer diseases have been observed during the first 6 months of life, characterized by epidemic occurrence, rapidly fatal course and uniform anatomic findings. Nassau [34] reported thirteen such cases, eight during the first quarter and five during the second quarter of life. There is usually severe nutritional disturbance with increased bowel movements, sometimes accompanied by evidence of an upper respiratory disease. The temperature rises, the skin changes to a dirty gray, and anxiety and pain appear in the facial expression. The breathing is shallow, dyspnea increases, and the heart weakens. Bloody, serous or purulent exudate may be aspirated. The bacteriologic findings during life and after death are not characteristic. Although the etiology is obscure, the patients should be isolated, for cases are observed in groups. The findings in the lungs are similar in all cases. Small round abscesses, approximately 1 cm. in diameter, are scattered throughout the lung. Bleeding into the lungs and destruction of the tissue are absent. A fibrinous exudate occurs over the pleura. Perforation of a small subpleural abscess into the pleural cavity is not an infrequent starting point of acute empyema. Metastasis to other organs is never found, nor are there any histologic changes in other organs.

Friedberg,[35] while experimenting with salicylic acid ester of ethylhydrocuprien observed a case of intoxication, and this caused him to discontinue the use of this drug because its therapeutic dose lay too near the toxic threshold. Intravenous injection of quinin urethan was discarded because of injury to the endothelial lining of the veins. Necrosis followed subcutaneous injection on one occasion, but it did not occur

33. Foote, J. A.: The Infantile Thorax of the Rachitic Child as a Predisposing Factor in Bronchial Infections, Internat. Clin. **2**:239-243, 1922.

34. Nassau, E.: Zur Kenntnis der Klinik und Epidemiologie der "abszedierenden Pneumonie" im Saüglinsgsalter, Arch. f. Kinderh. **71**:161-169 (July) 1922.

35. Friedberg, E.: Zur parenteralen Chinintherapie der Lungenentzündungen im Kindesalter, Arch. f. Kinderh. **71**:264-269 (Aug.) 1922.

after 800 intramuscular injections. Friedberg used from 1 to 4 c.c. of a 1:10 dilution. By thorough heating, the precipitation of quinin crystals could be prevented. Injections were given on the first, second and fourth days, sometimes as many as ten injections in fourteen days. The fever dropped, appetite returned and the dyspnea disappeared. The toxicity of the infection seemed to be lessened, even though, on physical and roentgen-ray examination the changes in the lungs were found to persist. The average duration of bronchopneumonia is from ten to fourteen days, but intramuscular injections reduced it to four days. In fifty-eight cases treated with quinin fifty-two were abortive, while in seventy-two cases treated by hydrotherapy only two were abortive. The results were especially prompt in pneumococcus pneumonia, the influenzal pneumonias being unaffected.

The chicken possesses a natural immunity to infections commonly found in the respiratory tract, except those due to the *Streptococcus hemolyticus*. Berger and Montgomery,[36] therefore, injected from 300 to 500 c.c. of whole chicken blood intramuscularly into children suffering from pneumonia. The good results obtained were inversely proportional to the duration of the disease preceding the injection. The great relief from toxemia was shown by the immediate drop in the rate of respiration to approximately normal, remaining there throughout the illness, the disappearance of cyanosis, the increase in appetite and the notable change in the child's reaction to his surroundings. It is necessary to determine the presence or absence of sensitization to chicken in any patient giving a history of asthma. Blood was given without waiting to determine the bacteriology in the case. No figures were quoted.

Foley[37] used intramuscular injections of ether up to 2 c.c. daily, with very satisfying and encouraging results in the treatment of infantile bronchopneumonia. In two cases sloughs were produced at the point of puncture. It had no effect in whooping cough.

CHRONIC NONTUBERCULOUS RESPIRATORY DISEASES

Lederer[38] observed seventy-three children with chronic nontuberculous respiratory disease over a long period. He classified this condition under three types: (1) congenital; (2) acquired during the first three weeks of life, and (3) acquired later. Type 1 includes malformations and conditions resulting from fetal atelectasis, the chief etiologic factors being difficult labor and familial predisposition. These conditions are aggravated by rickets, intercurrent infections, unhygienic

36. Berger, H. C., and Montgomery, J. G.: The Use of Chicken Blood in the Treatment of Pneumonias in Children, J. Missouri M. A. **20**:81-83, 1923.

37. Foley, G.: Contribution au traitement de la bronchopneumonie infantile, Arch. de méd. d. enf. **25**:58-59, 1922.

38. Lederer, R.: Die chronischen nichttuberkulösen Atmungserkrankungen des Kindesalters, Jahrb. f. Kinderh. **96**:198-231 (Oct.) 1921.

living conditions and the exudative diathesis. The prognosis in cases of Group 2 is unfavorable; 50 per cent. of the patients die. Lederer advises, therefore, the exclusion of all persons with colds from the care of the new-born. The cases in Group 3 are based on familial predisposition, such as exudative diathesis, aggravated by rickets and infectious diseases, such as measles and whooping cough. The prognosis is favorable so far as life is concerned, but doubtful for complete cure. These cases are subdivided into (*a*) diseases of the nose and pharynx, (*b*) chronic persistent bronchitis, (*c*) chronic pneumonia, including chronic infiltration of the lungs and chronic indurating processes involving the pleura also, and (*d*) bronchiectasis.

Von Piltz [39] believes that bronchiectasis, either cylindric or saccular, is not so rare in children as is usually believed, and that probably a certain number of cases recognized in later life can be traced back to childhood. The signs of bronchiectasis in childhood are so indefinite that this possibility must be considered in any case of pneumonia which lasts unusually long. Residual changes in the parenchyma of the lung and pleura do not seem to play a part in its causation, the chief factor being the injury to the walls of the bronchus, in association with other factors which aid in dilatation.

Rist [40] used pneumothorax in the treatment of bronchiectasis. In order to obtain a lasting result in all these cases it is necessary to maintain the pneumothorax for a long time.

PLEURISY

With a view to deciding whether serous pleurisy of unknown origin in children is of a tuberculous nature and whether children with serous pleurisy develop pulmonary tuberculosis later, Neuland [41] examined forty-five patients. He concluded that the majority of serous idiopathic pleurisies in children have nothing to do with tuberculosis, although he does not deny the connection between a great number of serous pleurisies and tuberculosis. Of twenty-four children with tuberculous pleurisy, eighteen were completely restored after from one to ten years; two others had doubtful signs, but were in good condition. Five of the children with a negative Pirquet reaction at the time of the pleurisy were afterward found to be free from tuberculosis. Neuland believes that the prognosis in children is much better than in adults, but they must be seen from time to time, and if pulmonary disease develops, they should be energetically treated.

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39. von Piltz, G.: Beitrag zur Kenntnis der Bronchiektasie im Kindesalter, Monatschr. f. Kinderh. **22**:551-574 (Jan.) 1922.

40. Rist, E.: Le traitement des dilatations bronchiques par le pneumothorax artificiel, Bull. méd., Paris **36**:246-248, 1922.

41. Neuland, W.: Atiologie und Prognose der Serösen Pleuritis beim Kinde, Klin. Wchnschr. **1**:470-472 (March 4) 1922.

EMPYEMA

McLendon,[42] writing on empyema in artificially fed infants with special reference to nutrition and diagnosis, says that artificially fed infants are more prone to parenteral infections than those who are breast fed, that these cases are problems of nutritional as well as of surgical treatment, and the physician should handle them accordingly. So-called lobar pneumonia preceded empyema in most cases. During pneumonia, a suppurative process elsewhere, as in the ear, increases the possibility of empyema as a complication. Tactile flatness is the most important single sign in diagnosis, and aspiration should be used rather than roentgen-ray examination to determine the need for operation.

It has been shown that the virulence of the pneumococcus decreases during the course of pneumonia, and Widowitz [43] finds clinical evidence to support this, for the prognosis of metapneumonitic empyema is more favorable, the greater the interval between the pneumonia and the empyema. The pneumococcus was the etiologic factor in 88 per cent. of the cases of empyema, and the mortality here was 17 per cent. as compared with 71 per cent. in cases of empyema due to the streptococcus. He advises conservatism in the treatment of the cases due to the pneumococcus: aspiration and then irrigation with from 20 to 30 c.c. of a needlessly complex iodin solution (Pregl's solution) every two or three days. For those not due to the pneumococcus, he advises radical operation. As a further evidence of the decrease of virulence in the pneumococcus, he reported a case of pneumococcic meningitis, proved by lumbar puncture, with almost complete absence of meningeal signs, in which cure was effected. He believes that mild forms of metapneumonic pneumococcus meningitis are often present, but giving no symptoms, are not diagnosed.

Of 100 patients treated by Pybus [44] for empyema, sixty-one were boys and thirty-nine were girls. The pneumococcus was isolated in forty of fifty-nine cases examined. The most important sign was dulness. In most cases bronchial breathing and moist sounds could be heard over this dull area, which was deceiving. Therapeutic aspiration is advisable only if the patient is too ill to stand incision, or when the condition is bilateral; local anesthesia is preferred. Rib resection was performed in 75 per cent. of the cases; in 7 per cent. secondary operations were required. Recently, in a few cases the pleura was opened more widely, washed with a solution of one of the flavine dyes and the wound almost entirely

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42. McLendon, P. A.: Empyema in Artifically Fed Infants with Special Reference to Nutrition and Diagnosis, Internat. Clin. **1**:166-173, 1923.

43. Widowitz, P.: Ein Beitrag zur Pathogenität des Pneumokokkus bei metapneumonischen Erkrankungen im frühesten Kindesalter, Arch. f. Kinderh. **70**: 246-252 (Jan.) 1922.

44. Pybus, F. C.: Empyema in Childhood, Practitioner **107**:238-245 (Oct.) 1921.

closed. The results cannot as yet be definitely ascertained. The total mortality was 24 per cent.

Caprioli [45] advises early thoracotomy to avoid the absorption of toxins and to prevent the lung from forming adhesions which offer a serious impediment to cure. He allows the pus to discharge slowly, so that complete emptying takes place in twenty-four hours. To do this he makes the thoracic aperture at a slightly higher level than the incision in the skin, introduces a double rubber drain, and then applies a compression bandage. His mortality was about 22 per cent. In cases in which vaccinotherapy was associated with surgical treatment, the postoperative course was more regular and the cure more rapid. He observed a series of thirty-six children, aged from four to ten years.

Poynton and Reynolds [46] describe a method of continuous gentle aspiration by means of a cannula, a rubber tube slightly larger than the cannula, so that it fits snugly, and White's suction pump, as used for suprapubic drainage. By using local anesthesia, the patient is disturbed very little. There is a minimum of surgical trauma and no dressings are required. The pus is gradually removed and the expansion of the lung is assisted.

Nasso [47] advocates repeated aspiration for empyema with intravenous and intramuscular injections of autogenous vaccines. The diplococcus of Fraenkel was cultured from the pus in all cases and a vaccine made containing two million organisms for each cubic centimeter. This was given every day in doses of from 0.20 to 0.50 c.c. intravenously, or from 0.50 to 2 c.c. intramuscularly. If autogenous vaccines cannot be made, stock vaccines may be used. Fifteen cases were reported; ten patients were cured; two did not report after treatment; one died, and two ultimately required operation because of difficulty in finding the purulent pocket with the needle, and because the exudate re-formed continuously.

Gralka [48] aspirates the pleura in the dependent portion. With a second needle higher, he introduces from 30 to 40 c.c. of 0.5 per cent. freshly prepared, sterilized and warmed solution of ethylhydrocuprein in distilled water, and withdraws this through the first needle. Depending on the character of the exudate, he uses from 100 to 200 c.c. of solution, increasing from 0.5 per cent. to 2.5 per cent., and finally to a 5

45. Caprioli, N.: La Toracotomia nella pleurite purulenta, Pediatria **30**: 877-880 (Sept. 15) 1922.

46. Poynton, F. J., and Reynolds, F. N.: A Method for Diminishing Mortality in Empyema in Infancy and Childhood, Lancet **2**:1100-1103 (Nov. 26) 1921.

47. Nasso, I.: Contributo alla terapia delle pleuriti purulente nell' infanzia, Pediatria **30**:841-852 (Sept. 15) 1922.

48. Gralka, R.: Ueber die Behandlung von Pneumokokenempyemen im Kindersalter mit Optochin, Monatschr. f. Kinderh. **23**:280-289 (June) 1922.

per cent. solution. He then instills half of the usual oral dose, which is 0.05 gm. ethylhydrocuprein for each kilogram of body weight; thus for a child weighing 6 kg. he gives 0.15 gm. ethylhydrocuprein, or 3 c.c. of a 5 per cent. solution. For older children he never uses more than 0.5 gm. ethylhydrocuprein, or 10 c.c. of a 5 per cent. solution at a dose. He reported seven cases. One patient required surgical intervention later, but in the others he felt that the duration of the disease was shortened. Ethylhydrocuprein is supposed to have an elective action on the pneumococcus. He believes that thoracotomy and rib resection for pneumococcus empyema in the first and second years of life are contraindicated.

Brown [49] studied the relative value of rib resection and intercostal incision in a series of 259 cases. Following rib resection, 76 per cent. were improved or cured, as against 53 per cent. following simple incision. The best results were obtained by exploratory aspiration with removal of enough of the pleural exudate to relieve symptoms of pressure until adhesions had formed. This can be determined by the fluid becoming frankly purulent, except in the cases due to the streptococcus. Drainage is then instituted by rib resection under local or general anesthesia, a simple fenestrated rubber tube being inserted. As the discharge diminishes, from 2 to 5 per cent. dichloramine-T is substituted for the surgical solution of chlorinated soda.

PNEUMOTHORAX

From a review of the literature, Schönfeld [50] found that spontaneous pneumothorax in childhood results from (1) a rupture of a nontuberculous (rarely a tuberculous) abscess of the lung into the pleural cavity, usually leading to pyopneumothorax, (2) mechanical causes, such as bursting of an alveolus following coughing, resulting in empyema, and (3) perforation of the pleura due to a foreign body. He reported six cases; four occurred during grip or pneumonia, apparently due to rupture of a small abscess or emphysematous vesicle. In two cases mediastinal and cutaneous emphysema resulted. Diagnosing these cases is difficult, for there are few signs. The roentgen-ray examination is of value. The four children with pneumothorax and one with mediastinal emphysema died. In sudden collapse in infants during the course of an influenzal pneumonia, it is necessary to consider the possibility of the formation of a spontaneous pneumothorax as an etiologic factor.

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49. Brown, H. P.: Empyema Thoracis. Analysis of Two Hundred and Fifty Cases Treated at the Children's Hospital of Philadelphia, Ann. Surg. **77**:401-408, 1923.

50. Schönfeld B.: Zur Frage des Spontanpneumothorax im Kindesalter, Monatschr. f. Kinderh. **24**:225-235 (Dec.) 1922.

Martin and Knox [51] reported a case of tuberculous mediastinal adenopathy in which definite pneumothorax developed. There was no gross pulmonary lesion, which would almost certainly precede such a complication in an adult.

MISCELLANEOUS

Gold [52] believes that bronchial cysts are typical malformations of the lung at the tracheal bifurcation, containing the elements of the bronchus and embryonic lung. He reported four cases examined at necropsy.

De Lange and de Vries Robles [53] reported the case of a child, 2½ months old, whose clinical examination suggested brain lesion. Multiple angiomas were found in the lungs, and extreme degeneration of the liver and heart muscle existed, for which there was no satisfactory explanation. While this might have been a case of angiosarcoma with metastasis, it was probably a benign lesion.

According to Duhem,[54] pulmonary sclerosis may be partial or complete. Of the former he recognizes two types, the hilum and diaphragmatic types. A number of these are only discovered by roentgen-ray examination. The partial scleroses usually do not cause any deviation of the heart.

Pierson [55] examined eighty apparently normal children. Only thirty-two were normal by roentgenogram, physical examination and Pirquet test. He believes that this criterion is too rigid, finding it hard to conceive that so large a proportion of children were abnormal. In acute bronchitis, no roentgenographic changes are demonstrable. Pneumonic consolidations, however, are detected earlier by roentgen-ray examination than by physical signs. The roentgen-ray diagnosis of bronchopneumonia is more difficult. It must be distinguished from tuberculous infiltration and metastatic sarcoma. It is hard to distinguish the fibrosis following bronchopneumonia from the fibrosis of tuberculosis. In tuberculous infections in children the primary lesion may be anywhere in the lung, and tuberculous consolidation at the base is not uncommon. Enlargement of the mediastinal glands is almost pathognomonic of disease, especially in young children. The diagnosis of thymus enlargements and the chest findings in rickets were discussed.

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51. Martin, W. B., and Knox, R.: Pneumothorax in a Boy Aged Seven; Recovery, Brit. M. J. **1**:472-473 (March 25) 1922.

52. Gold, E.: Ueber Bronchuscysten und deren Entstehung, Beitr. z. path. Anat. u. z. allg. Path. **68**:278-295, 1921.

53. de Lange, C., and de Vries Robles, S. B.: Ueber Lungenangiome bei einem Säugling, Ztschr. f. Kinderh. **34**:304-309 (Jan.) 1923.

54. Duhem, P.: Scléroses pulmonaires partielles et deviations du cœur dans les scléroses étendues du poumon chez l'enfant, Arch. de méd. d. enf. **24**:663-669 (Nov.) 1921.

55. Pierson, J. W.: Diagnosis of Pulmonary Conditions in Children, Am. J. Roentgenol. **9**:11-14 (Jan.) 1922.

Abstracts from Current Literature

Pathology and Bacteriology

A Study of the Acid Base Equilibria of Arsphenamin Solutions. Elias Elvove and W. Mansfield Clark, U. S. Pub. H. S. Bull. **135**:1, 1924.

Obvious errors were found in the indicator method of measuring the p_H of arsphenamin solutions. Hydrogen electrode measurements are more reliable. Arsphenamin, when alkalinized to the disodium salt as is recommended, has a p_H of 11.3, which is strongly alkaline and also has a strong buffer action. Alizarin yellow R was found to be usable for a clinical laboratory to check correct alkalinization of arsphenamin solutions.

The Biological Standardization of Arsphenamin and Neoarsphenamin. George B. Roth, Hyg. Lab. Bull. **135**:13, 1924.

A comparison is made of the methods used in different countries to determine toxicity. The mouse, rat and guinea-pig may be used, the two former being preferable for the commercial laboratory. Arsphenamin is about twice as toxic as neoarsphenamin in each of these species.

The Osmotic Pressure of Arsphenamin and Neoarsphenamin in Solutions. James M. Johnson, Hyg. Lab. Bull. **135**:33, 1924.

Variations in osmotic pressure bear no relation to arsenic content, but are probably due to variations in inorganic salt content. Five per cent. neoarsphenamin solutions are only rarely isotonic.

Quantitative Studies in Syphilis from a Clinical and Biological Point of View. XI. Partition of Arsenic in Serum and Clot After Intravenous Administration of Arsphenamin, Neoarsphenamin and Silver Arsphenamin. John A. Fordyce, Isadore Rosen and C. N. Myers, Am. J. Syphilis **8**:193, 1924.

The arsenic content of the serum is considerably higher after neoarsphenamin than after arsphenamin and silver arsphenamin. This would indicate a superiority of neoarsphenamin for treatment of neurosyphilis, especially when using the Swift Ellis method.

XII. Arsenic Content of Blood After Intravenous Injection of Tryparsamide. Ibid.

Tryparsamide leaves the circulation faster than arsphenamin, neoarsphenamin or silver arsphenamin, the most leaving in the first fifteen minutes. The general curve of arsenic content of the blood at different intervals is similar to that for the other drugs. Individuals who do not excrete the tryparsamide rapidly usually show toxic symptoms.

XIII. Arsenic Content of Cerebrospinal Fluid After Intravenous Injection of Hypertonic Salt Solution and Neoarsphenamin. Ibid.

This method resulted in uniform penetration of arsenic into the cerebrospinal fluid but the amount was not as great as with the Swift Ellis method.

Sutherland, Chicago.

THE RELATION OF THE CHEMICAL CONSTITUTION OF CERTAIN ORGANIC ARSENICAL COMPOUNDS TO THEIR ACTION ON THE OPTIC TRACT. A. G. YOUNG and A. S. LOEVENHART, J. Pharmacol. & Exper. Therap. **23**:107, 1924.

In this brilliant investigation, the authors studied the relation of the constitution of the organic arsenical compounds to the development of lesions in the optic nerves of rabbits. They found that those organic arsenicals with an amino group or a substituted amino group in the para position to the arsenic produce lesions in the optic tract of the rabbit. Organic arsenicals with the amino group or the substituted amino group in the ortho or meta position to the arsenic produce no such lesions. From their work they conclude that the valence of the arsenic is not the most important factor in the production of the optic lesions, but that in certain instances it can modify the intensity of action of a given arsenical on the optic tract, as shown by a comparison of the effects of N-phenylglycinamid—p-arsonic acid and arsenophenylglycin. The former, a pentavalent arsenical, more readily produces optic lesions than the latter which is a trivalent arsenical, although both contain a substituted amino group in the para position to the arsenic.

ARTIFICIAL PYREXIA INDUCED IN RABBITS BY INJECTIONS OF PLANT NUCLEIC ACID. FLORENCE M. HILL, J. Pharmacol. & Exper. Therap. **23**:87, 1924.

Miss Hill observed that the intravenous injection of yeast nucleic acid into rabbits to the extent of 0.1 gm. per kilogram of body weight induces a progressive rise of temperature, which reaches its maximum about three hours after injection.

KRAMER, Baltimore.

THE RELATION OF BLOOD PRESSURE TO THE AMOUNT OF RENAL TISSUE. HILDING C. ANDERSON, J. Exper. Med. **39**:707, 1924.

In eleven rabbits, the parenchyma of one kidney was reduced, either by the removal of a wedge-shaped piece or by the production of infarcts by cutting through different areas with loops of silk thread, and at another operation the other kidney was removed entire. Blood pressure readings were made with an instrument devised for the determination of the blood pressure in the central artery of the rabbit's ear. The blood was analyzed from time to time for creatinin and urea nitrogen by the method of Folin and Wu. The author comes to the conclusion that the removal or destruction of about 70 per cent. of the kidney tissue in rabbits does not produce hypertension, even when prolonged renal insufficiency results.

MCCLURE, Evanston, Ill.

THE EFFECT OF VITAMIN DEFICIENT DIETS ON RATS, WITH SPECIAL REFERENCE TO THE MOTOR FUNCTIONS OF THE INTESTINAL TRACT IN VIVO AND IN VITRO. LOUIS GROSS, J. Pathol. & Bacteriol. **27**:27, 1924.

A deficiency of vitamin B was followed by marked stasis in the colon. Histologically, no definite lesions could be demonstrated in the colon of any of the vitamin deficient animals. It was noted that in the retroileocecal lymph glands of vitamin B deficiency rats there was a definite increase in the incidence of pigment bearing cells. In man, the increase of pigment cells was found only in chronic long drawn out conditions, whereas in these rats they occurred after relatively short periods of stasis.

THE MECHANISM OF ANAPHYLACTIC LEUCOPENIA IN DOGS. R. A. WEBB, J. Pathol. & Bacteriol. **27**:79, 1924.

Webb studied the total leukocyte cells, differential count, and peripheral blood in the liver, spleen, lung, and bone marrow, and also the total and differ-

ential counts in the pulmonary artery and vein. The outstanding feature is the very marked decrease in leukocytes in the pulmonary vein as compared with pulmonary artery. Histologically this difference was explained by the enormous number of polymorphonuclear cells crowding the capillaries, where they appear to be firmly adherent to the endothelial lining. The same condition was found by Andrewes in the lung capillary, following injection of bacterial antigen into the immunized rabbits.

HELMHOLZ, Rochester, Minn.

THE EFFECT OF X-RAYS ON BONE MARROW. ERNEST H. FALCONER, LAIRD M. MORRIS and HOWARD E. RUGGLES, Am. J. Roentgenol. **11**:342 (April) 1924.

By repeated bone marrow punctures and smears the effect of the roentgen ray on the cells of bone marrow in the tibias of dogs was studied. No untoward effects were produced by the frequent puncturing of the bone.

Direct radiation of the long bones in both light and heavy doses had no appreciable effect on the contained marrow cells. Repeated small doses over the spleen produced a slight increase in the marrow cells of the tibia of the dog. There was also an increase in the proportion of immature marrow cells. Radiation over the spleen also increased the number of platelets in the peripheral circulation and this remained throughout the experiment. The general condition of both groups improved and the hemoglobin and red cells increased.

STULIK, Chicago.

IMMUNOLOGIC SIGNIFICANCE OF VITAMINS. IV. INFLUENCE OF LACK OF VITAMIN C ON RESISTANCE OF THE GUINEA-PIG TO BACTERIAL INFECTION, ON PRODUCTION OF SPECIFIC AGGLUTININS AND ON OPSONIC ACTIVITY. C. H. WERKMAN; V. E. NELSON, and E. I. FULMER, J. Infect. Dis. **34**:447 (May) 1924.

Nine guinea-pigs rendered scorbutic by vitamin C low diets were injected intraperitoneally with suspensions of pneumococci. Eight normal controls were treated likewise. The average number of days before death in the scorbutic animals was three and in the controls four.

Seven scorbutic guinea-pigs and seven controls were injected with *B. Anthracis*. The time before death in the scorbutic animals was 2.6 days and in the controls 3 days.

Five scorbutic and seven control animals were injected with killed broth cultures of typhoid bacilli and the blood was tested for specific agglutinins. No difference in the production of agglutinins was noted.

Phagocytic activity was tested with serums of four scorbutic and four normal animals by the method of Wright. No difference in the phagocytic activity was noted.

The slight, but definite, reduction of resistance to infection on the part of the scorbutic animals was attributed chiefly to the reduced body temperature which resulted from the lack of vitamin C in the diet.

KENNEDY, Rochester, Minn.

FACTORS AFFECTING THE SUSCEPTIBILITY OF FROGS TO THE CONVULSANT ACTION OF ACID FUCHSIN. J. E. THOMAS, J. Pharmacol. & Exper. Therap. **23**:307, 1924.

Abel first observed that acid fuchsin causes a late tetanus in frogs. Barbour and Abel later reported that the toxicity of this drug was greater for decerebrate frogs than for normal frogs, so that in the former animals convulsions not only appeared within a few minutes but could be produced by much smaller doses than were necessary for normal animals. The increase of toxicity of acid fuchsin for decerebrate frogs was thought to be due to the loss of cerebral

inhibition. The present paper by Thomas is an attempt to prove that "cerebral inhibition is a minor factor, if it is a factor at all, in determining the time of onset of acid fuchsin convulsions."

THE PHARMACOLOGY OF PHORADENODRON FLAVESCENS (AMERICAN MISTLETOE). P. J. HANZLIK and W. O. FRENCH, J. Pharmacol. & Exper. Therap. **23**: 269, 1924.

Hanzlik and French present a complete survey of the pharmacologic action of Phoradendron Flavescens (American mistletoe). Aqueous and alcoholic extracts of American mistletoe were injected intravenously into anesthetized dogs, cats, and rabbits in doses of 0.2 c.c. per kilogram of body weight. They observed a fall of blood pressure followed by a definite rise. Accompanying this pressor effect was an increase of the heart rate and of cardiac volume, a decrease of the splenic and kidney volumes and anuria. The muscle of the excised uterus as well as that of the intact organ, was made to contract. A similar action on some of the muscles from other tissues was observed. The drug seems to exert its effect on the muscle itself, since the administration of drugs which paralyze the nerve endings does not interfere with its pharmacologic action. Given intravenously it may be of value in circulatory collapse in the anesthetized individual where its action resembles that of epinephrin. When administered subcutaneously or intramuscularly in doses of 0.5 c.c. of the extract per kilogram of body weight, the pulse rate may be increased and the blood pressure raised. Even large doses given by mouth show no definite pharmacologic action.

FURTHER OBSERVATIONS ON ANAPHYLACTOID PHENOMENA FROM VARIOUS AGENTS INJECTED INTRAVENOUSLY; IBID., TREATMENT OF ANAPHYLACTOID PHENOMENA FROM SOME AGENTS BY HYPERTONIC SUGAR AND SALT SOLUTIONS, 237; IBID., EFFECTS FROM THE INTRAPERITONEAL INJECTION OF VARIOUS AGENTS CAUSING ANAPHYLACTOID PHENOMENA, 243. P. J. HANZLIK and H. T. KARSNER, J. Pharmacol. & Exper. Therap. **23**:173, 1924.

In this series of papers, Hanzlik and Karsner call attention to the dangers of intravenous medication. The intravenous injection of a variety of chemical agents in untreated guinea-pigs, cats and dogs causes systemic reactions which they characterize as anaphylactoid phenomena. The symptoms are often indistinguishable from those of true anaphylactic shock, but the lungs show important differences grossly and histologically. These differences consist of pulmonary congestion and hemorrhages, together with thrombosis and embolism. These pathologic changes are not present in the lungs of animals suffering from true shock. The smooth muscles of the bronchi and uterus are not hyperexcitable. The primary symptoms are not relieved by atropin and epinephrin, and many of the agents agglutinated red blood corpuscles in vitro.

The clinical manifestations, which were observed with a majority of the agents used, were restlessness, irritability, dyspnea and sometimes convulsions and death. Histologic changes could be demonstrated in the lungs in many instances, even in the absence of clinical symptoms. On the other hand, not every animal that showed symptoms had either gross or microscopic changes in the lungs.

The intravenous injection of hypertonic solutions of cane sugar shortly before the administration of acacia, beef serum or kaolin, did not prevent the appearance of anaphylactoid phenomena in guinea-pigs, nor did the intravenous injection of 10 per cent. sodium chlorid prevent the symptoms which follow the injection of kaolin.

When a number of these agents were administered by intraperitoneal injection the effects were qualitatively the same but differed in degree from the results obtained when the same agents were injected intravenously. The symptoms appeared more gradually and were more lasting. The reader is referred to the originals for details.

SOME HITHERTO UNDESCRIBED PROPERTIES OF THE CONSTITUENTS OF WITTE'S PEPTONE. JOHN J. ABEL and E. M. K. GEILING, J. Pharmacol. & Exper. Therap. **23**:1, 1924.

The authors prepared three fractions from Witte's Peptone, consisting of primary albumoses, secondary albumoses and a fraction which was soluble in alcohol. These fractions were injected intravenously into dogs and their effect on the blood pressure and the capillaries of the skin and visible mucous membranes was studied.

Animals receiving the albumose injection responded at first with a marked fall of pressure and other symptoms similar to shock. Subsequent injections, administered after the blood pressure had returned to normal, had very little or no effect on the blood pressure of the animal. In unanesthetized dogs the administration of albumose was followed by a marked reddening of the skin and visible mucous membranes due to capillary dilatation. The injection of the alcohol soluble extract was followed by reactions identical with those observed after the injection of histamin. The animals did not develop tolerance to this fraction even after repeated injections. The authors conclude that the action of the alcohol soluble fraction of Witte's peptone is due to histamin. They believe that although histamin itself does not exist in the tissues of the living animal, it is present in the form of a labile precursor from which it may be liberated by acids, employed in the chemical treatment of the organ extracts. They are able, in every instance, to split off histamin from Witte's peptone and from the tissues of any organ of the body, even when bacterial action is completely excluded. They also assert that albumoses are present in the tissues of living animals, but not in the blood, and suggest a possible relationship between some of the various forms of skin affection that are observed in hypersensitive human beings, such as urticaria, angioneurotic edema, eczema and other types of dermatitis, and the presence of these albumoses.

PHARMACOLOGICAL ACTION OF PRIMARY ALBUMOSE IN UNANESTHETIZED DOGS. E. U. K. GEILING and A. C. KOLLS, J. Pharmacol. & Exper. Therap. **23**:29, 1924.

The authors review briefly the pharmacologic effects of anesthetics, particularly ether, and emphasize the fact that the action of a drug may be quite different in unanesthetized as compared with anesthetized animals.

They injected primary albumoses into unanesthetized and into etherized dogs and studied the blood pressure, the capillaries of the skin and visible mucous membranes and the size of the heart. With equivalent doses of primary albumose, the unanesthetized animal showed a fall of blood pressure which affected the systolic pressure and the pulse pressure, the diastolic level remaining constant. In etherized animals the diastolic pressure also fell, but not as much as the systolic pressure. In the unanesthetized animal a marked reddening of the skin, due to dilatation of the capillaries and venules, occurred. This effect was observed only rarely in the etherized animals and then was less marked. The heart was decreased in size in both the unanesthetized and etherized dogs during the period that the blood pressure was lowered. The decrease in the size of the heart in the unanesthetized animals was attributed to the increased capacity of the capillaries and venules.

DRUG RESISTANCE OF TRYPANOSOMES WITH PARTICULAR REFERENCE TO ARSENIC. CARL VOEGTLIN, HELEN A. DYER and D. WRIGHT MILLER, J. Pharmacol. & Exper. Therap. **23**:55, 1924.

The authors review briefly our present knowledge of the phenomenon of drug resistance induced in unicellular organisms. They report a study of the nature of the resistance of trypanosomes to arsphenamin. Albino rats were

used as the host, *Trypanosomoa equiperdum* as the infecting organism and arsphenamin as the drug.

When large doses of arsphenamin were administered to rats and these animals shortly thereafter inoculated with trypanosomes, the animals were completely protected against the infection. When inoculation with trypanosomes occurred fourteen or twenty-one days after the drug was administered, infection took place, as evidenced by the presence of parasites in the blood, twenty-four hours after inoculation. Such trypanosomes develop resistance to arsphenamin. This increase of resistance persisted for a very long time. It can be established in the living animal host or in vitro, provided that a toxic arsenical is used, in the latter case. The arsenic resistance can be reduced temporarily by passing a given strain through another mammalian host, such as the dog or the rabbit. However, rabbit serum itself has no appreciable trypanocidal action. A change in the arsenic resistance does not alter the virulence of a given strain. It is feasible to isolate a strain of higher from a strain of lower resistance in the living mammalian organism by treatment with a proper dose of arsenical. The authors show that certain sulphydrils, such as cystein and glutathione, have a detoxifying effect on certain toxic organic arsenicals. This can be demonstrated by testing the toxicity of these compounds on trypanosomes of a high degree of arsenic resistance as well as on a so-called "normal strain." They suggest that the resistance of certain tissues and of certain organisms to toxic organic arsenic compounds may be due to their content of sulphydril compounds, such as glutathione or the action of organic arsenic compounds may be due to their effect on the system (which regulates the respiration of protoplasm) of which glutathione is a component.

KRAMER, Baltimore.

Nutrition

THE SIGNIFICANCE OF THE PROTEIN FRACTION OF BLOOD PLASMA IN INFANCY. J. DUZAR and S. RUSZNYAK, Monatschr. f. Kinderh. **28**:25, 1924.

Citrated blood was examined by a number of different methods as to its protein content. Several normal children, as well as those suffering from nutritional and contagious diseases, were examined. The writers conclude that the blood of the normal nursling shows very constant characteristic reactions, which are definitely influenced by age and by disease. More work is being done.

GERSTLEY, Chicago.

FAT TISSUE AND FEVER. AD. CZERNY, Jahrb. f. Kinderh. **105**:24, 1924.

In nasopharyngeal infections the reaction with a higher or lower temperature is partly dependent on the kind of nourishment. In children with exudative diathesis, the avoidance of milk and eggs and fats has a favorable effect on high temperature. Fat, pasty children are more severely affected by high temperatures, probably because with fever the available carbohydrate is soon used up, and there follows rapid metabolism of fats and a tendency to acetone formation. The metabolic products of fat do not affect the temperature regulation, but the fat metabolism is affected by the febrile reaction, and if the breaking down of fats is too rapid, it may cause considerable disturbance.

OLD AND NEW RICKETS PROBLEMS. E. GLANZMANN and L. SIEFFERT, Jahrb. f. Kinderh. **105**:99, 1924.

This is a discussion of the literature of rickets with a few additional observations on experimental rickets in rats. Roentgen and necropsy findings show experimental rickets to be similar to clinical rickets. The growth factor A of cod liver oil is destroyed by oxidation and drying, while the antirachitic factor is still present, so the two factors cannot be identical. Attention is

called to the fact that infantile rickets does not respond as well to cod liver oil as does experimental rickets, and that tetany was not observed in the rickets of rats.

RICKETS AND CONGENITAL MYXEDEMA. J. BERNHEIM-KARRER, Jahrb. f. Kinderh. **105**:31, 1924.

According to some writers these two conditions cannot occur in the same person. The author presents a typical case of cretinism in an infant, aged 4½ months, in which there was also a definite suboccipital craniotabes, though roentgenograms of the hands were negative for rickets. Distinct improvement in the symptoms of cretinism followed the giving of thyroid. At the age of 10½ months there was a slight rosary.

VITAMIN DOSAGE WITH LEMON JUICE, AND ITS ACTION IN INCREASING OXIDATION. K. ASADA, Jahrb. f. Kinderh. **104**:301, 1924.

On the basis of a feeding experiment with a dog, the author concluded that for each kilogram of body weight, the vitamin content of 100 c.c. of whole milk and 7 c.c. of lemon juice is sufficient to maintain the body weight. This amount is also sufficient to prevent and heal scurvy, since the content of factor C in lemon juice is much greater than of B and D. There was a greater amount of oxygen per kilogram per minute used when sufficient lemon juice was given than when the amount was insufficient.

SUTHERLAND, Chicago.

THE EFFECTS OF REMOVAL OF DENTAL INFECTION ON CHRONIC GASTROINTESTINAL DISORDERS. G. RESSE SATTERLEE, M.D., New York M. J. & Rec. **119**:481 (May 21) 1924.

A clinical article with a list of patients suffering from various maladies such as "chronic invalidism" cholecystitis, toxic neurasthenia, asthma, toxic psychosis, duodenal ulcer, hemicrania and the like. These troubles are in adult patients with the exception of one in a child, aged 12 years. The author's opinion is that infected teeth must be regarded as a possible source of toxic material leading to the troubles mentioned. The results of the treatment are not always clearly indicated in the article, but such statements as "no permanent relief from operation until extraction of infected teeth" leads one to wonder whether more attention should not be paid to the teeth as possible sources of infection in childhood.

BYFIELD, Chicago.

STUDIES IN INTESTINAL BACTERIOLOGY. I. AGNES GOLDMAN, J. Infect. Dis. **34**:459 (May) 1924.

The jejunal contents of four healthy persons were aspirated by means of a special tube, and examined in regard to the number and kinds of bacteria present. The level was from 40 to 65 inches (101 to 165 cm.) from the teeth. Twenty hospital patients with a variety of conditions were likewise studied; on some a number of studies were made.

The number of viable bacteria in the contents of a number of normal persons and hospital patients varied within wide limits.

The number of viable bacteria in the contents of diseased persons confined to a light meat-free diet usually appeared to be considerably higher in patients with gastro-intestinal disturbances or with diseases associated with metabolic disturbances or with focal infections of possible gastro-intestinal origin than in patients with diseases apparently unconnected with the alimentary tract.

The flora, in normal and pathologic cases, was usually of mixed bacterial character and form, with widely varying metabolic requirements, multiplying in the same specimen.

Even when the contents were entirely dominated by one bacterial species, further analysis into cultural and biochemical properties revealed the presence of two or more varieties.

Several specimens from the same person taken under similar conditions usually showed approximate correspondence in bacterial numbers and in the predominant species.

Gram-negative bacilli of the colon group, gamma type streptococci, and gram-positive bacilli of the acidophilus group appeared to be a normal feature at the levels studied.

Spore-bearing aerobes, accompanied by proteolytic activity, appeared to be a normal feature of the intestinal contents.

Anaerobes were absent in four normal specimens but were found in many specimens from pathologic subjects, but not necessarily in all specimens from the same person. Large numbers of spore-bearing aerobes were not so common as in specimens from normal persons. The presence in considerable numbers of spore-bearing aerobes was attributed to the presence of meat in the diet.

STUDIES IN INTESTINAL BACTERIOLOGY. II. THE EFFECT OF SPECIAL FEEDING ON THE INTESTINAL FLORA. AGNES GOLDMAN, J. Infect. Dis. **34**:502 (May) 1924.

Twenty specimens of intestinal contents from a female patient with arthritis deformans were examined and studied under varying conditions. The strain of *B. acidophilus* which was fed in large quantities, could not be implanted in the intestine. Lactose feeding was more effective in increasing the number of *B. acidophilus*. It seemed most effective, however, in increasing the number of streptococci.

Large numbers of viable *B. acidophilus* introduced directly into the small intestine were rapidly eliminated.

After a diet sterile except for a broth culture of *B. acidophilus*, the intestinal content at a depth of 75 inches (190 cm.) was almost sterile, streptococci being the only recoverable organisms in a few tubes of liquid medium. It is suggested that streptococci may represent the indigenous bacterial flora of this patient at the level tested.

STUDIES IN INTESTINAL BACTERIOLOGY. III. A STUDY OF NONHEMOLYTIC STREPTOCOCCI FROM HUMAN INTESTINAL TRACT. AGNES GOLDMAN, J. Infect. Dis. **34**:509 (May) 1924.

From the intestinal contents of the patients with arthritis deformans, who furnished the material for study number 2, the same strain of nonhemolytic streptococcus, identified by agglutinin absorption methods, was twice recovered at an interval of two months.

The persistence of this strain was considered as probably indicating a well adapted flora, native to the intestinal tract of the person from whom the strain was isolated or a focus at a higher level from which the strain was at intervals disseminated.

Normal human serum appears to contain a high antibody content of group agglutinins for some nonautogenous streptococci from the small intestine.

KENNEDY, Rochester, Minn.

Prenatal Conditions

TWO CASES OF MONSTERS. A. E. CHISHOLM, Edinburgh M. J. **31**:198 (March) 1924.

Chisholm showed two anencephalous fetuses, with spinal bifida. Another fetus showed hydrocephalus, open pelvis, fusion of lower extremities with web-

bing of legs and thighs, a true band from foot to anal region, and a gross maldevelopment of the intestinal canal.

NEFF, Kansas City, Mo.

Diseases of the New-Born

THE QUESTION OF HERPES ZOSTER AND VARICELLA. JOHN BOKAY, Jahrb. f. Kinderh. **105**:8 (March) 1924.

The author made the first clinical observations thirty-six years ago, and called the attention to the probable etiologic connection of herpes zoster and varicella. There are about 200 cases observed and published in more than fifty articles in the literature up to the present year.

The connection of certain forms of herpes zoster with varicella seems to be entirely well founded through the clinical facts. This connection of the two diseases is shown in two different types. In Type I., herpes zoster is the primary disease and is followed after an incubation period of about fourteen days by one or more cases of chickenpox. In Type II, chickenpox is the primary disease and is followed by herpes zoster after a similar incubation period. Type I is more frequent, being represented by 85.5 per cent. of all observations.

It is interesting that in cases of secondary infection, chickenpox and herpes zoster sometimes appeared alternately.

Besides many exact observations, there are also other data which are apt to support the author's theory of etiologic identity of the two diseases. He reviews the dermatologic literature on herpes zoster, and thinks that the so-called "aberant vesicles" which are often described with herpes zoster, are nothing else but chickenpox vesicles. The epidemics of herpes zoster which are mentioned in the German, English and American literature, were probably of varicellous origin. Pathologic research seems to prove the author's theory. In the intervertebral ganglions, identical changes have been found in chickenpox and herpes zoster. Complement fixation tests with varicellous antigen and herpes blood, and with herpes antigen and chickenpox blood, showed positive results. Hematologic research and experiments on animals are still to be made.

The author thinks that the question is not only of theoretic, but also of practical importance and hopes that future research will bring more conclusive results.

ZENTAI, Baltimore.

PRESENCE OF THE MEASLES ORGANISM IN A STILL-BIRTH INFANT OF EIGHT MONTHS. P. RITOSSA, La Pediatria **32**:513 (May 1) 1924.

Ritossa reports a case of a premature infant born of a mother who had measles at the time of the birth. He was able to recover from the liver, spleen, kidneys, and bone medulla of the stillborn infant an organism that corresponded exactly morphologically with the diplococcus described by Caronia as the specific cause of measles. He concludes that although young infants are not susceptible to measles, the disease may be transmitted to the fetus in utero through the placental circulation, resulting in miscarriage or abortion in many cases; or the new-born infant may be born with symptoms of measles.

DE SANCTIS, New York.

Acute Infections

THE INFLUENCE OF VARICELLA ON THE TUBERCULOSIS SKIN TEST. HERBERT SCHÖNFELD, Monatschr. f. Kinderh. **27**:602, 1924.

Pirquet, and later Bessau and Schwenke have shown that the Pirquet test may, in the same individual, at times be marked and at times be slight. This

variation complicates the study of the effect of any infectious disease on the Pirquet test. One must know the make-up of the individual before attempting this study.

Schönfeld, in eight controlled cases, showed that varicella in one caused a total disappearance of the Pirquet reaction, in two a marked and in two a slight reduction, and in three no influence.

ATTEMPTED INOCULATION OF RABBITS WITH VARICELLA. OTTO TEZNER, Monatschr. f. Kinderh. **28**:39, 1924.

An attempt has been made to relate herpes zoster to varicella. The contents of the varicella vesicle was injected into the spinal cord of a rabbit. The rabbit died after seventeen days. An emulsion of a piece of brain of the rabbit injected intraspinally into a second rabbit was also fatal in seventeen days. Nothing definite, however, was proved as regards herpes zoster.

GERSTLEY, Chicago.

SKIN STREPTOCOCCUS TEST IN SCARLET FEVER. G. FANCONI, Jahrb. f. Kinderh. **105**:77, 1924.

Killed streptococci from different sources were injected intracutaneously and the reaction read in from twenty-four to forty-eight hours. During the first week of scarlet fever, the normal positive reaction became negative or practically so, and became positive again soon after the rash disappeared. This was true also of very mild cases of scarlet fever, but only in severe infections of other types. In measles the reaction was also negative, though in other exanthems the reaction was positive through the whole course of the disease. This test may therefore be of some value in differentiating the mild atypical cases of scarlet fever.

SUTHERLAND, Chicago.

STUDIES ON THE RESPIRATORY MECHANISM IN LOBAR PNEUMONIA. A STUDY OF LUNG VOLUME IN RELATION TO THE CLINICAL COURSE OF THE DISEASE. CARL A. L. BINGER and GEORGE R. BROW, J. Exper. Med. **39**:677, 1924.

The functional residual air (defined as the lung volume at the end of a normal expiration) was determined in a series of normal adults, and in ten adults having lobar pneumonia.

A constant relationship existed between the persistence and disappearance of symptoms (fever, increased heart rate, rapid and shallow breathing and cyanosis) and fluctuations of the functional residual air. With persistence of these symptoms the functional residual air decreased; during their disappearance the volume of the functional residual air rose toward normal. The rise was detected soon after the crisis.

A close parallelism has been observed also between alterations in radiographic shadow, physical signs and the volume of the functional residual air. The volume is diminished during persistence of pathologic signs in the lungs, and returns to normal as they disappear. In patients that recovered, the average time required for the functional residual air to become constant was from eleven to twelve days from the onset of the disease.

MCCLURE, Evanston, Ill.

DIPHTHERITIC VULVITIS. B. VASILE, La Pediatria, **32**:557 (May 1) 1924.

Vasile reports a case of diphtheritic vulvitis secondary to pharyngeal diphtheria. He states that most cases are secondary and are due to transmission from the primary lesion to the vulva which has been previously injured.

DE SANCTIS, New York.

Chronic Infections

TUBERCULIN IN DIAGNOSIS AND TREATMENT OF TUBERCULOSIS. ROBERT PHILLIP, Edinburgh M. J. **31**:153 (March) 1924.

Phillip, in discussing the diagnosis by the cutaneous and percutaneous methods, states that the observations based on the Pirquet and allied procedure have proved of epidemiologic rather than of immediate clinical value, proving that the occurrence of infection takes place usually in childhood. The reaction indicates that the individual is tuberculized, and under treatment is not *detuberculized* as long as the reaction remains positive.

Tuberculin administered by inunction (percutaneously) is of great value in a variety of tuberculous manifestations, is free from pain, and therefore of use in children; cutaneous and glandular foci show its curative influence in a few weeks. In children, when used for months, not only the enlarged gland becomes normal but there is evidence of benefit to enlarged glands throughout the body and a general improvement in health, an expression of progressive tuberculinization, as will be shown by records of many children. He advises this treatment in the earliest indication of chronic glandular enlargement in children. Koch's or Béraneck's from 10 to 50 per cent. strength in an excipient of 95 per cent. paraffin and 5 per cent. oxycholesterin from wool fat. Approximately 0.1 c.c. of tuberculin may be thus used in inunction on one or two square inches of clean skin, applied with a glass rod.

RADIOLOGY IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS. J. A. WILSON, Edinburgh M. J. **31**:172 (March) 1924.

Wilson, of the Glasgow Public Health Department, notes the rarity of hilum tuberculosis in 200 children under 10 years of age, suffering from chronic respiratory infections, in contrast to its almost epidemic occurrence in certain other parts of Scotland. Sixty per cent. did show root shadows, invariably after measles, etc., but as they return to normal in from four to eight months they should not be labeled tuberculous, and none have developed pulmonary tuberculosis.

PERSISTENT USE OF TUBERCULIN IN TUBERCULOSIS. ROBERT PHILLIP, Edinburgh M. J. **31**:26 (Feb.) 1924.

Phillip emphasizes the fact that a long time is necessary to get good results in any treatment for gross tuberculosis, and in addition a suitable antigen (Koch's old tuberculin) should be administered persistently, by the percutaneous method. One of his cases was a girl, aged 13 years, operated on two years before for tuberculosis of the tibia, without recovery. The scar had broken down, and an extensive sinus persisted. Treatment with tuberculin for sixteen months brought about a local cure, and the patient is now the picture of health.

NEFF, Kansas City, Mo.

RICKETS AND CONGENITAL SYPHILIS. O. COZZOLINO, La Pediatria **32**:505 (May 1) 1924.

Cozzolino states that in his experience, congenital syphilis is not the most common cause of rickets. After the World War syphilis was more common than ever before in Italy, and still there was not a proportionate increase in the number of cases of rickets. The inherited syphilitic element is traceable only in a few cases of rickets. He states that the mere fact that the Wassermann reaction is positive does not necessarily mean that syphilis is the direct cause of the rachitic changes in the skeleton. More proof that rickets is not associated with syphilis is that rickets responds to antirachitic treatment alone.

DE SANCTIS, New York.

TUBERCULOSIS IN INFANCY. L. MOLL, Monatschr. f. Kinderh. **28**:58, 1924.

There are two forms of tuberculosis in infancy, an early and a late form. The early form is due either to tuberculosis of the placenta or to definite intrauterine infection of the fetus by a tuberculous mother. These forms, fortunately rare, begin within the first three months after a short period of well-being. It is usually fatal within the first half year. Necropsy shows generalized tuberculosis with large caseous foci.

The late form of tuberculosis is of much greater importance, owing to its greater frequency. In contrast to the former this type is more chronic and often heals, especially after the first year. Infection in this case is either aerogenic or occasionally by direct contact, as by kissing. These children, in spite of the involvement of bronchial glands, often continue to thrive and gain unless the environment is strictly unfavorable.

GERSTLEY, Chicago.

PENETRATION OF NORMAL MUCOUS MEMBRANES OF THE RABBIT BY TREPONEMA PALLIDUM AND THE INFLUENCE OF THIS MODE OF INFECTION UPON THE COURSE OF THE DISEASE. WADE H. BROWN and LOUISE PEARCE, J. Exper. Med. **39**:645, 1924.

Emulsions of three strains of *Treponema pallidum*, tested separately, caused infection in rabbits when instilled into the conjunctival sac or the penile sheath. This infection differed from that produced by intracutaneous or testicular inoculation, in that it pursued a mild or asymptomatic course and frequently without the development of a characteristic chancre. The authors point out that these experiments may have a bearing on problems pertaining to obscure and atypical cases of human syphilis.

MCCLURE, Evanston, Ill.

FELLNER'S PAPULE SUBSTANCE. G. BESSAU and O. KÖHLER, Jahrb. f. Kinderh. **105**:39, 1924.

In no case did the papule substance have any effect on the tuberculin reaction (as had been claimed by Fellner). The author concludes that sensitization to tuberculin and specific resistance to tuberculosis are functions of living cells.

THE ACTION OF TUBERCULOSIS SERUM. C. KRAEMER, Jahrb. f. Kinderh. **104**: 304, 1924.

Recent work suggested to the author similar treatment which he had used on a patient, aged 24, who had had open pulmonary and laryngeal tuberculosis twenty years ago. The serum was obtained from an immunized cow. Whether due to the serum or not there was a complete and apparently permanent recovery in six months. Such a method would be indicated in an open rather than a latent tuberculosis.

FURTHER OBSERVATIONS ON THE KAHN REACTION IN THE SEROLOGIC DIAGNOSIS OF SYPHILIS. HARTHER L. KEIM, Am. J. Syphilis **8**:323, 1924.

The later modifications of the Kahn reaction, which allow final readings within a few minutes, have increased the sensitiveness of the test without losing any of its specificity. This test is a valuable addition to the serology of syphilis.

SUTHERLAND, Chicago.

CUTANEOUS TUBERCULIN REACTION. A. B. MARFAN, Nourrisson, **12**:9, 1924.

Marfan gives a detailed account of the discovery of tuberculin by Koch, and the failures which attended its early use, especially in the treatment of

tuberculosis. Its use had been practically given up in 1907, when Pirquet discovered the cutaneous reaction which still bears his name. Marfan has made use of this test in his services since 1908, and has been impressed with its great value in making the diagnosis of tuberculosis in infants under 2 years; he is convinced that a positive reaction connotes the presence of living tubercle bacilli, "at least one living bacillus," somewhere in the body and in infants under 1 year this always means an active tuberculous process; in infants between 1 and 2 years a dormant tuberculosis is possible but very rare, but becomes more common with increasing age until in adult life fully 97 per cent. give a positive reaction.

The local reaction is due to the lysins circulating in the blood acting on the tuberculin, and liberating endotoxins of sufficient strength to set up a local reaction, but too weak to produce either a focal or a general reaction. Three types of cutaneous reactions are described:

1. The strongly positive reaction, in which a vesicle or pustule may develop. Whether this means a recent infection with a high concentration of circulating antibodies, indicating a favorable prognosis, is not entirely clear. At any rate, strongly positive reactions are found as a rule in those cases referred to as scrofulous.

2. The weakly positive reactions characterized by a small, pale papule, less than 5 mm. in diameter. Such reactions are found in patients with far advanced pulmonary or with miliary tuberculosis.

3. The late reaction, which begins to appear only after three or four days or longer. These may signify old foci, long dormant and able to produce the lysins, only slowly and in small amounts.

Negative reactions may be had in tuberculous patients due to certain anergies. (1) The anergy of the incubation period. This period varies within considerable limits, from six days to four months, but in the majority of cases it is between twenty and thirty days; (2) the anergy of advanced tuberculosis with cachexia. This form of anergy is rare in infants, even in those suffering from miliary tuberculosis or tuberculous meningitis; (3) the anergy found in women during menstruation, pregnancy, labor and lactation; (4) the anergy due to certain other diseases, e. g., measles, pneumonia, epidemic influenza, whooping cough, serious diseases of the liver and perhaps some others; (5) the anergy due to intensive treatment with tuberculin. Seldom are any of these anergies present in infants, which greatly enhances the value of the reaction at this age. The difficulties of making a diagnosis of tuberculosis in infants are often great, especially when the involvement is limited to the tracheobronchial glands. Without the help of the tuberculin reaction it would often be impossible to make a positive diagnosis.

Marfan refers briefly to the other local reactions of tuberculin, the ophthalmic reaction, which he condemns as being too dangerous, and the intracutaneous test, which he admits may be more sensitive, but considers too complicated for routine use.

(This is hardly in accordance with the practice in this country, where the original Pirquet test has been largely abandoned in favor of the more delicate intracutaneous test. J. E. M.).

McClelland, Cleveland.

Internal Diseases

Transfusion in Hemophilia. J. M. Graham, Edinburgh M. J. **31**:21 (Feb.) 1924.

In a case of hemophilia in a boy, aged 8 years, suffering from collapse during hemorrhage, 500 c.c. of compatible citrated blood was given intravenously, a clot formed in five minutes and bleeding stopped. The good effect lasted for four weeks. Transfusion is the most certain way of arresting hemorrhage in

hemophilia by reducing the coagulation time of the blood, and it further restores the general condition to normal. While only temporary, the risk from hemorrhage diminishes as the child grows older. The critical periods can be tided over by retaining a suitable donor for supplying blood at such times.

(1) Pyloric Stenosis. (2) Cretinism. Norman Carmichael, Edinburgh M. J. **31**:31 (Feb.) 1924; Tr. Medico-Chirur. Soc., Edinburgh.

Two infants were presented: 1. A boy, aged 2 months, with congenital hypertrophy of the pylorus, who had lost 2 pounds (907 gm.) in weight at 6 weeks of age, showing vomiting, visible peristalsis, and a pyloric tumor. Medical treatment failing, a Rammstedt operation stopped the vomiting, but a daily loss of 1 ounce (30 c.c.) of weight persisted for five days after which he gained 22 ounces (650 c.c.) in thirteen days and recovered normally. 2. A boy, aged 18 weeks, was noticed since his second month to have an enlarged tongue, increased saliva, regurgitation of food, eyes and features puffy, cold hands and feet, and lowered intelligence. Just what special feature of the case warrants reporting is not mentioned.

Neff, Kansas City, Mo.

Eclampsia—Is It a Biological Necessity? O. M. Gruhzit, Am. J. Obstet. & Gynecol. **7**:588, 1924.

The author reports fifteen clinically diagnosed cases of eclampsia or preeclampsia. The blood grouping in mother and child was incompatible. Five other cases of pregnancy toxemia with convulsions in which the blood grouping was compatible are also reported. In eighty-three cases of normal pregnancy the blood grouping was normal between mother and child.

He concludes that the pathologic changes in eclampsia can be explained satisfactorily on the basis of a new colloidal condition in the mother's blood stream which is produced by the interagglutination between the maternal and fetal blood. This new colloidal condition is an increased viscosity, causing the increased blood presence, spasticity of capillaries, general edema and stasis, which in turn slow body oxidation, increase acidosis and accumulation of carbon dioxid in the blood stream.

The patients that have a low viscosity and blood of normal type but develop the toxemias with convulsions are probably suffering from nephritis.

Allen, Chicago.

Clinical Observations on Rickets. Erich Aschenheim, Monatschr. f. Kinderh. **28**:69, 1924.

The condition of the muscles in rickets has not been sufficiently emphasized. It is a mistake to deny the presence of rickets simply because there are no bone changes. The writer believes that the diagnosis of rickets can be made largely from the observation of great muscular weakness. Whether this is primarily muscular or nervous is not certain.

The writer also believes that rickets may have some effect on the intelligence. In a survey of backward children he found that a large proportion of them showed signs of rickets.

Gerstley, Chicago.

The Effect of Direct Radiation Over the Precordium on the Heart Size, the Heart Mechanism and the Myocardium of Rabbits. Burgess Gordon, G. F. Strong and E. S. Emery, Jr., Am. J. Roentgenol. **11**:328 (April) 1924.

Sixteen rabbits were subjected to direct radiation over the precordium. Some were given large single doses, or moderately large repeated doses, others

received frequently repeated small doses for several months. Seven were radiated over the abdomen to determine any indirect effect on the heart.

Electrocardiographic tracings and roentgenograms were made before radiation and at frequent intervals during treatment. In estimating the heart size the heart shadow was traced on smooth white paper and the silhouettes cut and weighed.

One rabbit developed ventricular extrasystole after two hours and five minutes of radiation given in fifteen minute doses once a week. These disappeared after treatment was stopped. No appreciable change in heart size was found. The seven radiated over the abdomen developed diarrhea. The heart muscle in several instances showed small areas of necrosis or fatty infiltration, suggesting the condition described by MacCallum in the heart muscle of varying infections, intoxications and nutritional disturbances.

STULIK, Chicago.

THE EFFECT OF EXPERIMENTAL EXCLUSION OF THE LIVER ON THE FORMATION OF BILE-PIGMENT. A FURTHER CONTRIBUTION TO THE STUDY OF HAEMOLYTIC ICTERUS. J. W. M'NEE and B. PRUSIK, J. Pathol. & Bacteriol. **27**:95, 1924.

Experiments along the same lines as those on dogs by Whipple and Hooper were undertaken. Fifteen experiments are reported in which the hemoglobin was introduced into the circulation of the dog, the liver being excluded. In only two was there a small amount of bilirubin found. The conclusion drawn from their experiments is that the hemoglobin is not rapidly changed into bile pigment within the circulating blood when the liver has been excluded. Their work is opposed to the view held by Whipple and Hooper.

HELMHOLZ, Rochester, Minn.

NOTE: It has been proved definitely that after an interval of several hours bilirubin is always found in the body after the total removal of the liver. (Bilirubin Formation after Total Removal of the Liver, Mann, Bollman, and Magath: Am. J. Physiol. **68**:1, 1924.)

THE ROENTGEN RAY AS AN AID TO DIAGNOSIS IN CARDIAC LESIONS. IRWIN P. LEVI, J. Radiol. **5**:41, 1924.

Fluoroscopic examination is stressed, as it gives an opportunity to observe the actual working of the heart. The position, size, shape, rate and rhythm may be studied directly. Extra systoles, heart block and fibrillation can be detected if present. In favorable cases, the auricular as well as ventricular pulsations may be counted. Both lateral views should be studied as well as the anteroposterior. The author recommends making orthodiagramatic drawings. These are made by using a piece of glass or architect's tracing paper over the screen. The target to screen distance should be 24 inches (60 cm.). The tube should be screened so that only the central ray is used, the tube carriage being released, the intensifying screen fixed, the thoracic outline, apices and cardiac silhouette area sketched. This drawing is of advantage in being able to outline the apex and to include the effect of the various phases of respiration on the cardiac outline. Films should be taken with the target to film distance being 2 meters (78 inches), in order to prevent distortion. The usual exposure time is approximately one second, so that both the systolic and diastolic cycles are included. By knowing the normal anatomy and its appearance as portrayed by the roentgen ray, one may draw quite definite conclusions as to the probable pathologic changes. The author describes in some detail the normal cardiac curves and discusses the usual measurements made on the film. While valve lesions cannot be actually diagnosed, the author describes the changes in outline and size which indicate their presence. Pericardial

effusion and adhesions are demonstrable and give characteristic shadows. Stress is placed on the actual association of the clinical history and findings with the roentgen-ray examination.

CHAMBERLAIN, Chicago.

Nervous Diseases

TUMOR OF THE HYPOPHYSEAL STALK. JOHN FRASER, Edinburgh M. J. **31,** 1924.

Fraser showed a case of developmental tumor of the hypophyseal stalk in a girl, aged 9 years. The symptoms were adiposity, squint, headache, deterioration of vision. The roentgenogram revealed a calcified, partly cystic epithelial tumor of the stalk producing a deficiency of the anterior lobe, with Fröhlich's syndrome, also interruption of the right optic tract with irritation of the third cranial nerve and an increase in intracranial tension. The only suitable treatment in this case seemed to be decompression, which was done, with considerable improvement resulting.

CASE OF BRAIN ABSCESS. J. M. MORGAN, Edinburgh M. J. **31**:198 (March) 1924.

Morgan showed a case of brain abscess of otitic origin with spontaneous rupture and recovery in a girl aged 4 years, who had had otorrhea a year previously, and then developed a series of convulsions and in a few days became drowsy. There had been discharge from the right ear, paralysis of the right arm and leg, the right eye turned upward and there was double optic neuritis. At operation, pus and necrosis were found in the antrum, and 4 ounces (118 c.c.) of pus drained from the temporal lobe. The patient made an uneventful recovery. The features of the case were the long time of development of the abscess, late and sudden onset of paralysis, and the favorable "pointing" of the abscess to the periphery.

NEFF, Kansas City, Mo.

EPIDEMIC ENCEPHALITIS IN INFANTS. E. APERT, Nourrisson **12**:25 (Jan.) 1924.

Apert speculates regarding the etiologic changes of epidemic encephalitis but has nothing new to offer. He mentions the possibility of placental transmission and of transmission through the maternal milk, but admits that such cases must be rare. The symptoms in infants are quite as varied as in older children and adults, while the sequelae are just as uncommon and as unusual in their manifestations. Perhaps many of the mental disturbances heretofore considered idiopathic or constitutional may be the result of an atypical encephalitis in infancy. There are undoubtedly many abortive types of this disease and the incidence in infants seems to be increasing. Of the cases of epidemic encephalitis seen by Apert last winter, two-thirds were in children under 6 years of age.

MCCLELLAND, Cleveland.

ENCEPHALOGRAPHY IN INFANCY. WILHELM KNOEPFELMACHER, Jahrb. f. Kinderh. **105**:181, 1924.

The author presents cases in which the withdrawal of fluid from the lateral ventricles, followed by injection of air and taking roentgenograms was of undoubted diagnostic value in cases of hydrocephalus and brain abscess. In hydrocephalus the injection of air prevents a too rapid decrease in pressure following the withdrawal of fluid for therapy. The reactions consisted of vomiting, pallor, restlessness or stupor, and on one occasion collapse. On the day after encephalography there was an increased cell count of the spinal fluid, in one case to 500 cells per cubic millimeter, but the count was again normal two days later. The reactions were temporary.

SUTHERLAND, Chicago.

MONGOLIANISM IN TWO CHILDREN OF THE SAME FAMILY. HERBERT POGORSCHELSKY, Monatschr. f. Kinderh. **28**:65, 1924.

An interesting report of two cases of mongolian idiocy, which occurred in the first offspring of each of two sisters of the same family. This is most unusual, as more than one case in a family is exceedingly rare and the affected child is usually the last instead of the first.

GERSTLEY, Chicago.

THE HISTOLOGY OF THE CENTRAL NERVOUS SYSTEM IN AN ACUTE CASE OF ENCEPHALITIS PRESUMABLY EPIDEMIC. C. DA FANO, J. Pathol. & Bacteriol. **27**:11, 1924.

An exact description of the histologic findings of a case of lethargic encephalitis is given by the author. The unusually interesting feature is the acute infiltration in the upper portion of the medulla oblongata, in the pons, midbrain and cerebral cortex. The findings were identical with those seen in the acute hemorrhagic encephalitis of the so-called Strümpell-Leichtenstern type. The essential elements of the infiltration were polymorphocytes, lymphocytes and macrophages. There was acute nerve cell degeneration, with active penetration of polymorphocytes into the cytoplasm. The alterations found in the lower part of the medulla oblongata were the same as is described in mild cases of lethargic encephalitis, principally round cell infiltration. The author feels, therefore, that the present case is probably a typical one of lethargic encephalitis, and that the acute encephalitis of the Strümpell-Leichtenstern type is probably a sporadic form of lethargic encephalitis.

HELMHOLZ, Rochester, Minn.

CEREBROSPINAL MENINGITIS WITH FROIN'S SYNDROME IN AN INFANT. L. AURICCHIO, La Pediatria **32**:553 (May 1) 1924.

Auricchio reports a case of cerebrospinal meningitis in an infant aged 5 months. On lumbar puncture, a fluid was obtained which had the characteristics of the fluid in Froin's syndrome, namely: 1. It was yellow in color. 2. There was a massive coagulation of the fluid. 3. An increased number of lymphocytes. Froin's syndrome is very rare in any acute meningeal condition, only one case having been reported by him in cerebrospinal meningitis. The common causes of this syndrome are brain tumors, meningomyelitis and pressure from Pott's disease.

DE SANCTIS, New York.

TRAVERSING WOUNDS OF THE ORBIT. DAVID M. GREIG, Edinburgh M. J. **31**:241 (April) 1924.

Greig reports and has collected cases of traversing wounds of the orbit, ten of them in children under 15 years of age, from some penetrating object such as an umbrella rib, an arrow, needle, wire, scissors, pencil, stick of wood, broom and knife. He concludes that wounds which traverse the orbit are to be distinguished from merely penetrating wounds. Traversing wounds through the orbital plate are ultimately generally fatal, while those that leave the orbit through the superior orbital fissure are recovered from generally but leave some impairment of cerebral function, such as defective memory, cerebral irritability and hemiplegia.

Diseases of the Eye

MULTIPLE ARTHRITIS IN AN INFANT FOLLOWING OPHTHALMIA NEONATORUM. MARY H. MACNICOL, Edinburgh M. J. **31**; Tr. Med. Chir. Soc., Edinburgh 1924, p. 67.

MacNicol showed a boy, aged 3 months, who, following eye infection at birth and its cure in one week, had then developed inflammation of the left middle

finger and in the third week, the right knee, and at the eighth week a diffuse swelling over the upper five vertebrae, with thickening of the vertebrae. Gonococcal vaccine was given twice weekly, from one up to five billion organisms. The gain and well-being of the child had become normal. The mother during this period had gonorrhea and acute arthritis of the fingers and elbow.

NEFF, Kansas City, Mo.

XEROPHTHALMIA, KERATOMALACIA AND XEROSIS CONJUNCTIVAE. OLAF BLEGVAD, Am. J. Ophth. **7**:89, 1924.

The author has collected 434 cases of keratomalacia in children and 19 in adults, and 148 cases of xerosis without corneal involvement. All were observed in Denmark during the years from 1909 to 1920. The literature concerning these diseases since the nineteenth century, when its true nature was obscure, and the experimental work which established the importance of fat soluble A is reviewed.

The type of food given before the disease appeared was known in 295 children. In only twenty-two cases did the children receive whole milk as part of their diet, the others receiving foods poor in fat soluble A. The absence of the vitamin does not entirely explain the predisposition to keratomalacia, for these children were nearly all less than 1 year old and had suffered from digestive diseases, factors which in combination with the lack of fat soluble A caused the appearance of the keratomalacia, in the author's opinion. He draws the conclusion that the food poorest in fat soluble A produces the keratomalacia in the shortest time and that the youngest children live the shortest time on such a diet before the disease appears. The cases appeared principally during the winter and spring months, the number decreasing rapidly during the summer and fall. The disease usually does not attack children less than 1 month old, but in this series the greatest number were observed at 6 months of age and mostly in poor families. There was a loss of weight in the children before the outbreak of the disease.

The prognosis has always been considered bad. The average mortality is 50 per cent. In this series the percentage of deaths (usually bronchopneumonia) was 21.5, being higher in the younger, while no child over 3 years died. Twenty-seven per cent. were blind, 24 per cent. had greatly reduced vision, 35 per cent. had reduced vision in one eye and in 14 per cent. there was recovery without visual reduction. For years the oculists and pediatricians in Denmark have used whole milk in the treatment of keratomalacia, noting no difference in the good results if the milk was boiled for a short time. Cod liver oil being rich in fat soluable A has aided in the treatment.

WESCOTT, Chicago.

MONGOLISM AND HEREDITARY SYPHILIS. H. LEMAIRE, Bull. Soc. de pédiat. de Paris **22**:1 (Jan.) 1924.

Lemaire's assertion that hereditary syphilis is an outstanding cause of mongolism is based on twenty-one cases. In three there were positive Wassermann examinations; in the rest the diagnosis of syphilis rested on other evidence. The sharp division of French opinion on this subject was brought out in discussion. Comby, among others, felt that in the absence of the patients, errors in the classification, both as to mongolism and as to syphilis might have occurred.

The frank discussion demonstrates the confusion which is prevalent as to the definite and the probable signs of syphilis.

CROTHERS, Boston.

Diseases of the Nose and Throat

THE ETIOLOGIC RELATIONS BETWEEN CERTAIN NASAL AFFECTIONS AND BRONCHIAL ASTHMA. O. M. ROOT, Northwest. Med. **23**:185 (April) 1924.

Root states that the type of nasal affections bearing etiologic relation to bronchial asthma is that in which there is harboring and sequestration of bacteria, such as low grade sinus infections; not especially the pus forming kind, but those producing polypoid change of the lining membrane, such as in hyperplastic ethmoiditis. A cure of this may sometimes be effected by correcting the deflected septum and removing the middle turbinate. Some cases of asthma are cured by exenteration of the ethmoid cells. It must be remembered that there are several other types of asthma, the pollen group, the food group, the emanation group, and that it is only the bacterial group that can be benefited by operation.

PREVENTING SWIMMING POOL INFECTIONS. C. ULYSSES MOORE, Northwest Med. **23**:176 (April) 1924.

Pharyngitis, septic sore throat and otitis media frequently develop in those using public swimming tanks. In most instances this is due to dirty filters, and such pools usually showed bacterial counts above 500,000 per cubic centimeter. Bacterial counts in eleven Portland pools showed counts varying from 6 to 110,000 per cubic centimeter. Pool water can be disinfected by means of copper salts, ultra-violet light, ozone and chlorin. The chlorin method is efficient and harmless. The gas should be present in concentrations between 2 and 5 parts in 10,000. The pool should be well lighted, preferably by sunlight, the bathers should scrub with soap before entering and all persons with the slightest infections should be debarred. Moore recommends licensing of pool operators as milk dealers are licensed, monthly published bacterial reports, and the furnishing of water to pools at a reduced rate.

SCOTT, Philadelphia.

INDICATIONS FOR ROENTGEN THERAPY IN CHRONIC TONSILLITIS AND PHARYNGITIS. W. D. WITHERBEE, Am. J. Roentgenol. **11**:331 (April) 1924.

By means of a special head rest the central beam of the roentgen ray passes through the soft tissue posterior to the mandible. In this way the rays are not weakened by any bone passage.

The result is a marked shrinkage of the lymph tissue not only of the tonsils and adenoids, but also of the lingual tonsil, the infratonsillar nodules, lymph nodes on the posterior and lateral walls, lymph tissue of the fossa of Rosenmüller and the cervical glands. The large soft tonsil reveals the most spectacular results. Roentgenotherapy before operation materially lessens the amount of dissection.

Roentgenotherapy is especially recommended where an anesthetic is contraindicated; in patients past middle life with arteriosclerosis; where tonsils are imbedded in infected tissue; where surrounding lymphatic tissue is markedly infected; in repeated peritonsillar abscess; in recurrent pharyngitis following tonsillectomy; in vocalists with recurring pharyngitis, and in patients with chronic kidney and other diseases with lowered resistance.

In the discussion, Simpson cites much better results from a serial treatment with roentgen ray and radium. This therapy is regarded as a valuable adjunct to proper surgery of the nasopharynx.

STULIK, Chicago.

Diseases of the Skin

SEBORRHEIC DIATHESIS. MOSES SCHOLTZ, M. J. & Rec. **119**:334 (April 2) 1924.

Although the pediatrician has become accustomed to the term exudative diathesis as including a tendency to seborrhea, he prefers to regard the tendency to seborrhea as a separate constitutional tendency. He states that "the seborrheic person is born with a milk crust on his scalp which is the first evidence of seborrheic diathesis. . . What percentage of infantile and children's eczema is of seborrheic origin cannot be answered even approximately, as no statistical data on the point are available." He considers the various theories of origin, mentioning the parasitic, endocrinous and metabolic. He agrees with Montgomery that infantile seborrhea is due to a rapid absorption and deposit of milk fat in the skin. His more important conclusions are as follows: Seborrhea is a metabolic diathesis, congenital or hereditary, and the bacterial invasion is a secondary development. Seborrheic lesions are best controlled by an appropriate general regimen, dietetic corrections combined with local antiparasitic applications.

BYFIELD, Chicago.

CONCERNING ANNULAR GRANULOMA. CARL LEINER, Monatschr. f. Kinderh. **28**:42, 1924.

A report of a case of this rare skin condition which was first described in 1895. The clinical picture has three characteristics.

1. Localization mainly on the hands.
2. Tendency of the whitish individual lesions to group themselves into a ring.
3. Chronicity.

This disease has by some been associated with tuberculosis, but in this case histologic examinations and tuberculin tests were absolutely negative.

GERSTLEY, Chicago.

LOCALIZED, DRY, SCALING ECZEMATOID OF THE FACE. E. MORO, Jahrb. f. Kinderh. **105**:27, 1924.

This is a common affection after infancy, seen in children having a tender skin. The lesions are usually acute, rounded, usually distinctly elevated, slightly reddened, dry, scaling, and sharply outlined from the normal skin of the face. It occurs most often on the chin, around the mouth, on the cheeks, at the angles of the jaw, on the forehead and about the ears. It has a marked tendency to recur especially after exposure to wind, or change in the weather, and sometimes may be due to the soap and water. The duration without treatment is several weeks or months without change. It responds readily to some lotions mixed with water, salicylic-vaseline or liquor carbonis detergens and glycerin.

SUTHERLAND, Chicago.

Surgery and Orthopedics

PYLORIC STENOSIS IN INFANCY AND THE RAMMSTEDT-WEBER OPERATION. FEDINSKI, Monatschr. f. Kinderh. **28**:1, 1924.

The author discusses the subject on the basis of one patient who was successfully operated on by the Rammstedt method. He concludes, after reviewing the literature, that there are two forms of obstruction, the congenital hypertrophy of the pylorus and pylorus spasm. Often the two are combined. Stagnation vomiting is characteristic of the pure anatomic stenosis. All other symptoms, even palpation of the tumor, may occur in either form. If there is any question as to treatment, the patient should be operated on at once.

The author's conclusions do not seem based on extensive experience, nor does his bibliography show an intimate acquaintance with the literature.

CONCERNING INGUINAL HERNIA OPERATION IN CHILDHOOD WITH ESPECIAL CONSIDERATION OF THE NURSLING PERIOD. GUSTAV RANFT, Monatschr. f. Kinderh. **27**:545, 1924.

There are practically no statistics for radical hernia operations in small children before 1880. Since that time the pros and cons have been discussed by a number of writers. Pediatricians have opposed the operation for the reason that many of these hernias heal spontaneously. The writer, however, in somewhat sceptical of the permanency of these so-called spontaneous cures. He supports this contention in an unnecessarily verbose article giving his own operative statistics.

From his standpoint, radical operation is indicated in all hernias on account of the danger of incarceration. Should the latter occur, after a very short careful attempt at reduction, absolutely no time should be lost before operating. Of ten such patients operated on there was one death and one recurrence.

In fifty-three cases the contents of the hernial sac was: empty in twenty-four patients, omentum in two, small intestine in ten, large intestine in one, urinary bladder in two, testicle in one, small intestine, large intestine and omentum in one, appendix, cecum and small intestine in four, appendix and omentum in one and no report in seven.

The operative mortality in the series of uncomplicated cases was zero. The anesthetic used was chloroform or chloroform-ether. The average amount of chloroform used was 6 gm. The average time was thirty minutes or less.

An interesting complication was the discovery of a case of hemophilia in this series.

Ranft draws final conclusions from the results of 215 operations. He claims that the healing of the hernia due to the wearing of a truss is never sure. Radical operation is indicated in practically every case. In his large series there were 94 per cent. of primary healing, 2 per cent. recurrence and 5 per cent. mortality. Infancy is no contraindication to operation. However during the first three months, one is justified in more conservative treatment.

It goes without saying that before operation every child must be in good physical condition and must be gaining in weight.

When, for certain reasons, radical operation must be postponed, no local treatment is indicated.

GERSTLEY, Chicago.

CONGENITAL HIGH SCAPULA, AND BREVICOLLIS. DAVID M. GREIG, Edinburgh M. J. **31**:22-24, 1924.

Under a grant from the Carnegie Universities' Trust, Greig presents photographs of six cases of congenital high scapula, a term which he believes is preferable to that of "congenital elevation of the scapula." Not only the scapula but the neighboring structures must receive attention in the osseous development, as it may or may not be associated with other anomalies. Acquired high scapula is not included in his treatise.

Uncomplicated or true high scapula is less common than generally supposed. This scapular displacement is obvious and of no inconvenience to the patient, and a boy, aged 7 years, with his right scapula higher than the left had no defect of muscle or function, no abnormality of the ribs or spine, but only an increased angulation of the right scapula with the spine projecting into the neck. In the adult the affected scapula is inclined to be smaller. The general body height is under the average. The deformity must occur before the fourth month of fetal life and is a neuromuscular defect. A boy, aged 6 years, had an associated torticollis with right high scapula with a thin, tight right sternomastoid and a thin, prominent and fibrous right trapezius muscle. One boy, aged 11 years, had in addition to a right high scapula an absence of the corpus mammae and a defect in the second and third costal cartilages. The function of the right arm was disturbed, and the musculature bore a causal

relation to the scapular deformity. In cases presenting an omovertebral connecting structure, a band passes from the vertebral border of the scapula to the lower cervical or upper thoracic spinous processes which retains the scapula in its high position. There may also be abnormalities in the ribs or spine, and the connecting band is difficult to recognize in a plump infant. This may be recognized by a dimple at the vertebral border between the spine and the inferior angle. If the spine has a defect the scapular displacement may be overshadowed, and may be the primary deformity. A rib defect may also be causative though not so deforming.

The author reports six cases of brevicollis (short neck), in which the cervical spine has been arrested in development, with fusion of the vertebra. Congenital high scapula may coexist, as is also found in some cases of cervical ribs.

Congenital high scapula does not affect life. Surgical interference to be successful would have to be undertaken in early infancy, and only in those cases having an omovertebral connection, when a free division might reduce the scapula to its normal location. The objection to operation is in the formation of a mass of cicatricial tissue.

(1) Acute Cholecystitis. (2) Diverticulum and Ulcer Perforation. Grace Herzfeld, Edinburgh M. J. **31**:22 (Feb.) 1924.

Herzfeld showed two rare cases of acute abdominal conditions in childhood: 1. Acute cholecystitis in a girl, aged 6½ years, who after ten days of feeling ill had an attack of acute abdominal pain in epigastrium and constant vomiting for three days. On admission to hospital she showed rigidity in the right hypochondrium down to the anterior superior spine. Operation revealed a greatly distended gallbladder, 5 inches (12 cm.) in length, from which turbid fluid was drained, containing paratyphoid bacilli. The patient had an uninterrupted recovery.

2. A boy, aged 3 years, with Meckel's diverticulum and ulcer perforation, passed tarry blood, supposed on admission to be abdominal purpura. Ten days later intense abdominal pain brought the boy to operation where a diverticulum was found 30 inches (76 cm.) from the ileocecal valve, and at its juncture with the ileum a perforated ulcer was found. Resection of 4 inches (10 cm.) of ileum was performed, with uneventful recovery, of the patient. The section of the diverticulum showed the mucous membrane resembling the acid forming cells of the gastric mucosa, which Herzfeld believes accounts for the ulcer formation at the junction with the alkaline secretion of the ileum.

Treatment of Surgical Tuberculosis. Alex Mitchell, Edinburgh M. J. **31**:140 (March) 1924.

Mitchell states that a large proportion of cases of surgical tuberculosis is of bovine origin, such as cervical adenitis, tabes mesenterica, which at first are locally lymphatic infections. In bones and joints the disease is secondary to a hemic or lymph borne infection. In many cases the dairy milk is carrying tubercle bacilli from time to time. He advocates boiling the milk from large dairies, and in the country where children take the milk from one or two cows that these cows be examined.

For prevention of human infection, all cases of tuberculosis in human beings must be isolated. Since the regular inspection of school children, and the early removal of infected tonsils and adenoids, there have not been so many cases of tuberculous cervical glands.

Treatment of cervical glands by heliotherapy is the best. Roentgen-ray treatment is often unsuccessful, and causes harmful dense periadenitis. When the disease resists a few weeks treatment, Mitchell believes in a complete and thorough dissection in certain cases where the glands have completely broken down. Not dissection but scraping should be done in children under 2 years of age. He finds tuberculosis of long bones is rare, and then usually

in the metacarpal, when he uses subperiosteal resection, as bone regrowth occurs in children. Tuberculous joints and epiphyseal ends of long bones form an important part of the work in every children's hospital. Such infection is secondary to disease elsewhere in the body.

NEFF, Kansas City, Mo.

BENIGN BONE CYSTS (OTITIS FIBROSA). ACETABULAR CAVITY, UPPER END OF FEMUR, TROCHANTERS, NECK AND HEAD. JOSEPH COLT BLOODGOOD, J. Radiol. **5**:3, 1924.

Nine cases of bone cysts involving the acetabulum and upper end of the femur are reported. Four of these were observed in children aged from 7 to 10 years: four patients were between 18 and 25 years and one was 50 years of age. Three had suffered pathologic fractures which brought them under observation; the others were examined because of pain in the hip or a limp, or both. The education of the public to seek advice early, together with the more general use of the roentgen ray has increased the number of cyst cases observed. In each case reported the roentgen ray indicated the existing pathologic changes. The benign bone cyst is the most common of the central lesions of the bone with intact shell, especially in patients under 15 years of age. The author has never observed a central sarcoma of the upper end of the femur. The differential diagnosis includes benign giant cell tumors, tuberculosis, chondroma and myxoma. The author's procedure in patients under 15 years consists of bed rest and observation of the lesion by means of the roentgen ray. If there is no increase in size, the lesion is either tuberculosis or a benign cyst and surgical intervention is not indicated. The benign cysts often heal spontaneously, often rapidly, after fracture. However, it may enlarge, in which event operative measures should be undertaken. If a cyst is found the contents should be curretted and the cyst wall crushed. If a benign giant cell tumor, myxoma or chondroma is found, removal of the involved area should be done with the cautery.

CHAMBERLAIN, Chicago.

Miscellaneous

REPORT OF THE COMMITTEE ON MATERNAL WELFARE TO THE AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS, 1923. G. W. KOSMAK, HENRY SCHWARZ and G. C. MOSHER, Am. J. Obstet. & Gynecol. **7**:601, 1924.

The report is largely composed of statistics on the value of prenatal care from the different states, and cannot be reported in full.

We are impressed by the uniform reduction not only of maternal mortality, but of infant mortality in all instances where a program of maternal welfare has been carried on.

The most striking results were obtained in the localities where work was carried on under direct medical supervision, working in close cooperation with the different welfare societies.

The authors feel that by this close cooperation between societies, laity and the medical profession working with the funds provided by the Sheppard-Towner Bill, there will be a marked improvement in maternal and infant welfare in every state.

ALLEN, Chicago.

MODERN DEVELOPMENTS IN PEDIATRICS. O. HUEBNER, Jahrb. f. Kinderh. **105**:1, 1924.

This is the introductory article of this volume, which is dedicated to the 60th birthday of Emil Feer. It is a statement of progress in pediatrics and

lays emphasis on some of the problems which so far have remained unsolved. He calls attention to the hopelessness of tuberculous meningitis, the lack of a specific for encephalitis and poliomyelitis, and the nephroses of severe scarlet fever.

AGGRAVATION OF MALIGNANT LYMPH GLANDS BY INTENSIVE IRRADIATION. O. CRAMER, Jahrb. f. Kinderh. **105**:68, 1924.

The author presents two cases diagnosed as lymphosarcoma of the neck by tissue section, and lymphogranuloma of the mediastinum. Both patients responded well to roentgen therapy at first but later died of lymphatic leukemia. He considers that these were probably atypical cases of lymphatic leukemia which were aggravated by too strenuous roentgen therapy. These cases are of interest on account of our incomplete knowledge of the relationships of the lymphatic disturbances.

SUTHERLAND, Chicago.

News and Comment

The following appointments to professorial positions in various pediatric departments in the country, have been made:

1. Dr. Lawrence T. Royster, Norfolk, Va., to be Professor and Head of the newly organized Department of Pediatrics of the University of Virginia.

2. Dr. A. Graeme Mitchell, of the Pediatric Department of the University of Pennsylvania, Philadelphia, to be Professor and Head of the Department of Pediatrics at the University of Cincinnati.

3. Dr. Frederick W. Schultz, Associate Professor of Pediatrics, at the University of Minnesota, to be Professor and Head of the Department of Pediatrics in that institution.

4. Dr. P. C. Jeans, of the Pediatric Department of the Medical School of Washington University, St. Louis, Mo., to be Professor and Head of the Department of Pediatrics, at the University of Iowa, Iowa City, Iowa.

5. Dr. Samuel W. Clausen, of the Pediatric Department of the Medical School of Washington University, St. Louis, Mo., to be Professor and Head of the newly organized Department of Pediatrics of the University of Rochester, Rochester, New York.

6. Dr. Frank C. Neff, Kansas City, Mo., to be Professor and Head of the newly created Department of Pediatrics of the Medical School of the University of Kansas, Kansas City, Kansas.

7. Dr. Clifford G. Grulee, to be Clinical Professor and Chairman of the Department of Pediatrics, Rush Medical College, of the University of Chicago, recently created in the consolidation of Rush Medical College with the University of Chicago.

Book Reviews

PRACTICAL DIETETICS. By A. F. PATTEE. Mount Vernon, New York, A. F. Pattee, 1924.

Pattee's *Practical Dietetics* has long been known as a standard text, and has been a particular favorite for years with hospital dietitians. Its chief interest to the pediatrist lies in its excellent recipes and food tables.

It is the opinion of the reviewer that the sections on "Feeding of Infants and Young Children" should be omitted from books of this character. The author has usually no basis for judgment as to what should and should not be included in such sections, and is inclined to accept, as settled, statements concerning which there is a decided difference of opinion. Certain dietitians have styled themselves nutrition experts, although knowing next to nothing of the processes of digestion, and in the reviewer's opinion textbooks on dietetics should restrict themselves to their proper subject.

CONGENITAL SYPHILIS. Abstracts secured in the Compilation of Venereal Disease Information, and on file in the Division of Venereal Diseases. Compilation No. 2, Jan. 1, 1924. Issued under Assistant Surg.-Gen. Mark J. White, Chief of Division of Venereal Diseases, U. S. Public Health Service, Washington, D. C. One hundred and eleven pages. Free.

This is the most complete résumé of articles on the subject issued in recent years in American or European literature.

MEDICAL AND SANITARY INSPECTION OF SCHOOLS. By S. W. NEWMAYER, A.B., M.D. Price $4.00. Pp. 462. Philadelphia, Lea & Febiger, 1924.

This is a very timely book on a subject which is most interesting not only to the school physician but also to the general practitioner, and especially to the pediatrician. It is very comprehensive in its scope, touching on many subjects which are not familiar to the average physician.

The work begins with a somewhat general statement on the need of medical supervision, the duties of medical inspectors, nurses, etc., together with samples of records and the methods by which they are kept. This chapter also includes the question of the cooperation of teachers and principals together with the teaching of hygiene, and the inspection of teachers and janitors. We have always regarded this last subject a much neglected phase of school inspection.

The second part has to do with school buildings and grounds, is very complete and well illustrated. It not only has to do with city schools, but it takes up the question of this work in rural communities, and also the question of special courses.

The third part has to do with communicable diseases and is very complete, though condensed. Physical defects is the subject of the fourth part, with very detailed information regarding the examination of eyes, ears, nose, throat and teeth. Orthopedic defects and skin diseases are then referred to, followed by systemic diseases.

Part five refers to the health of teachers, and part six mentality. This very important chapter has quite detailed information together with suggestions for treatment of mental defects, etc.

Part seven has to do with allied conditions, such as medical inspection by teachers and nurses, rural school medical supervision, rural school sanitation, with regulations of the advisory board for the State Department of Health, a chapter on safety first, and the medical supervision of child labor.

This is a good contribution on a subject with which the medical profession, as a whole, is not generally familiar. The book is not so voluminous as to be tiresome, and yet gives every indication of being very complete.

Society Transactions

ST. LOUIS PEDIATRIC SOCIETY

March 28, 1924

GEORGE M. TUTTLE, M.D., *President*

SERUM PROPHYLAXIS IN MEASLES. Presented by DR. S. E. PESETKE.

In two institutions where twenty-one and twenty-nine children, respectively, were definitely exposed to measles, intramuscular injections of from 2 to 4 c.c. of convalescent serum proved highly successful. Only four cases of very mild, so-called "abortive measles," occurred subsequently. All the other children have been free from measles since that time (one year ago).

To obtain the best results with convalescent serum: (1) blood should be obtained between the seventh and fourteenth day after the fall of temperature; (2) mixed blood is preferable to blood from one patient; (3) it may be used fresh or preserved with phenol; (4) blood from adult patients seems to contain more potent antibodies; (5) if given within four days after exposure, from 2 to 5 c.c. is the immunizing dose. If delayed until the fifth or sixth day, the dose should be doubled; (6) the immunity conferred may last for from two to twelve months or longer.

CISTERNA PUNCTURE IN INTRACRANIAL HEMORRHAGE OF THE NEW-BORN. Presented by DR. J. M. BRADY.

Twenty-two cases of intracranial hemorrhage in newly-born infants have been observed; nine of those infants recovered completely following lumbar puncture. Puncture of the cisterna magna has been resorted to when lumbar puncture has failed. The first patient died six hours after the withdrawal of 30 c.c. of blood. Necropsy revealed an extensive hemorrhage above and below the tentorium.

The second patient, seen at the age of 13 days, was almost moribund, having had convulsions for several days. Lumbar puncture was unsuccessful. Twenty cubic centimeters of dark blood was withdrawn by cisterna puncture. The baby rapidly improved and at the age of 6 months was completely well. The method of performing cisterna puncture is described.

DISCUSSION

DR. ZAHORSKY: Before withdrawing cerebrospinal fluid in these patients, by whatever route, we must be very sure of our indications. If we are endeavoring to stop bleeding, it is questionable whether rapid release of pressure will accomplish this. Unless intracranial pressure is increasing and the symptoms are urgent, I advise waiting a few days before resorting to puncture.

DR. P. J. WHITE: Blood clots much more slowly in spinal fluid. This is important in both diagnosis (in differentiating from venous blood) and therapy.

DR. BRADY: All of the patients I have seen have been urgent cases, and lumbar or cisterna puncture could not have been delayed. We always give blood or serum intramuscularly to hasten clotting.

OBSERVATIONS ON PARENCHYMATOUS NEPHRITIS. Presented by DR. S. W. CLAUSEN.

Evidence is offered that chronic staphylococcus infection of the accessory nasal sinuses may play the chief rôle in the causation of chronic parenchymatous

nephritis. In all the cases of this type, seen over a three-year period, such infection was present. In several, each exacerbation of this infection was followed by increase in the nephritic symptoms. Successful treatment of the infection resulted in permanent relief of the symptoms. Other forms of treatment were of only temporary benefit. In other forms of nephritis, nasal sinusitis is not regularly present.

DISCUSSION

DR. ZAHORSKY: Why does not parenchymatous nephritis result more often from infection elsewhere than in the sinuses?

DR. MARRIOTT: I have seen this condition follow osteomyelitis and also empyema and skin infections. The staphylococcus aureus is the commonest offending organism.

DR. CLAUSEN: We must consider chronic parenchymatous nephritis a definite entity, a general disease affecting permeability, with resulting edema, ascites, etc.

LEVULOSE AS A TEST FOR LIVER FUNCTION. Presented by DR. KENNETH TALLERMAN (by invitation).

The use of levulose as a test for hepatic efficiency was presented. The technic employed in his test and the variations from normal in pathologic cases was dwelt on. Dosage of levulose does not appear to be important. Twenty grams may be employed as a routine unless this should exceed 3 gm. per kilogram of body weight of the patient. Curves illustrating changes observed in cases of jaundice, especially those following the administration of arsphenamin were shown. A marked rise in blood sugar occurs in these cases as opposed to the flat curve found in a normal subject, and the curve exhibits a lag. The results of some observations of ketosis due to infection in children by this means were given. They indicate that this condition is due to a temporary inability to use carbohydrate, probably due to a derangement of the glycogenic function of the liver, as opposed to increased carbohydrate metabolism or to inanition due to lack of appetite and food intake. The curves of these cases closely approximated those given by the patients suffering from hepatic inefficiency in cases of jaundice where a pathologic lesion of the liver is presumed both from the test and clinical evidence.

CHICAGO PEDIATRIC SOCIETY

Clinical Meeting, March 18, 1924, Sarah Morris Memorial Hospital

HENRY W. CHENEY, M.D., *President*

PINEAL GLAND TUMOR. Presented by DR. JULIUS H. HESS.

This boy, aged 21 months, was of normal birth, with spontaneous delivery. He was breast-fed for thirteen months, and developed normally but learned to walk very slowly. We first saw him when he was 15 months old, and at that time he was able to stand up and walk around a chair. He was just beginning to talk. His mother first noticed that he had pubic hair at about this time, and that the genitalia were larger than normal. His voice has always been very coarse, and all measurements are in excess of the average for his age. His head is larger than normal and the features are those of a much older child.

Pubic hair is present. The right testicle is about the size of a walnut, the left about two-thirds that size. There is no evidence of a tumor mass, although one is much firmer than the other.

Roentgenologic examination of the head and sella turcica gave negative findings. There are no focal findings such as might be due to intracranial pressure. There is no nystagmus, no paralysis of the eye muscles. The sight is good and the fundi are normal. There is no evidence of involvement of the suprarenals and while the genitalia are much more advanced in their development than is normal for his age, the size and shape of the skull and retarded mental development have led me to believe that there was some intracranial pathologic change. The Wassermann and tuberculin tests are negative.

Clinical reports of similar cases show that in most instances homosexual changes in the male have followed tumors of the pineal gland, while heterosexual changes have been secondary to involvement of the suprarenals.

CARTILAGINOUS EXOSTOSES. Presented by DR. MARK JAMPOLIS.

This boy, 10 years old, entered the hospital with a history of having had fractures of various bones for the last four years. Roentgen-ray examination disclosed the condition not as fractures but as multiple cartilaginous exostoses. As you can see, there is one at the lower end of the femur and another at the upper end, which is not so pronounced. The bone has a peculiar cystic appearance but the margins of these areas are not clear-cut as in true cysts of the bone. The skull shows a mottled appearance, as though the density varied in spots. Smaller growths are present on the tibia, and the knee regions show more pronounced exostoses than do the elbows.

One of the exostoses was removed from the lower end of the femur, and was found to consist of spongy bone covered with cartilage with a fibrous layer over that.

The chest shows a flaring downward with a moderate exostosis over the sternum. The scapulae show nothing.

In the ARCHIVES OF INTERNAL MEDICINE, 1920, four similar cases were reported, so the condition is evidently not as uncommon as has been thought. Honeij collected sixty-six cases in the literature, not counting his own four, and found that there was a definite family history in thirteen out of thirty-six cases, one or more members of the family having had the disorder. Not much is known as to the etiology but apparently there is no infection as a basis. Very little is known about the condition, except that it appears as rather a distinct entity. In this patient the calcium and phosphorus content of the blood is normal, as is the blood and urine.

INTESTINAL LESIONS. Presented by DR. ALFRED A. STRAUSS.

This patient when first seen was 2 months old and was brought to the hospital for an acute condition of the abdomen. There was a history of nausea and vomiting, the temperature was 104 F. and the child was extremely sick and in a state of shock. We made a diagnosis of an acute obstruction. Operation under local anesthesia disclosed a black gangrenous ileum, the muscularis of which began to rupture, exposing the mucosa, almost as soon as it was touched. We pinched the child and in its reaction to this it delivered all of the gangrenous bowel, which was about half of the ileum.

The pathology was an infected gland in the mesentery, to which the great omentum became adherent, this attachment acting as a lever on which rotated this large segment of about 4 feet of bowel, making a complete strangulation of this portion of the ileum, and causing the gangrene. We resected about four feet of the ileum just at the mesenteric border, made an anastomosis and folded the extramesentery on to itself, leaving it in place. I am sure that had we attempted to dissect the mesentery the child would have died of shock.

We have done this several times in children, always leaving the mesentery, and we feel that the lymph supply and the adhesions from the omentum give it plenty of blood supply to make it viable. In this case, within twelve hours after the operation, the child had a stomach full of typical contents of thick black gastric juice which was aspirated through a small duodenal tube.

It was interesting to see, after aspiration every two hours, that the vomitus became lighter and lighter in color, then bile stained, and finally clear. The regurgitation lasted for four days, a local ileus backing up from the point of anastomosis. Following this period the child made an uneventful recovery and within a week the wound was healed in spite of the loss of the four feet of ileum. The patient immediately gained in weight and is now, as you can see, a robust healthy child.

MECKEL'S DIVERTICULUM: This is a case of bleeding Meckel's diverticulum, and we have had four cases of this type. Two of them had been to many clinics and were diagnosed as acute hemorrhagic bowel. The interesting point about the four cases was that they all occurred in children between 1½ and 2 years of age, all with practically the same history. There would be bleeding lasting for a day or two, which would then stop, and occasionally there was very marked anemia. Roentgen-ray examination revealed nothing. In the first case we did not make the diagnosis. There was a tumor mass present, buried in the mesentery and attached to the ileum, which we removed, but we did not know that it was Meckel's diverticulum. In the second case and also in the third and fourth we discovered the Meckel's diverticulum. We did an anastomosis in all the patients, with recovery in all. Three of them required two blood transfusions before operation, but the last patient had only one. In one case the diverticulum was attached to the appendix, the blood vessels becoming attached formed a collateral circulation and this lymphoid vessel in the hollow dome became ulcerated and bled. I found nothing in the literature about this type of case.

TUBERCULOUS PERITONITIS: This patient was operated on six months ago for acute appendicitis. The surgeon told the parents that it was a very marked case of tuberculous peritonitis, and left in a drain. Following this, the tuberculous bowel broke down and the child developed a large fistula of the small bowel and became markedly emaciated. We attempted to ascertain by fluoroscopic examination how far up the fistula extended, and decided that it was about half way between the ileocecal valve and pylorus. We opened the abdomen under gas anesthesia and passed in a catheter through the original appendix wound. The bowel was studded with large tuberculous pearls, the large and small bowel were matted together and greatly compressed, but the colon showed practically no pathologic change and no tuberculous pearls. This was dissected away from the inside, and, contrary to all rules, we did an end-to-end anastomosis, left in a small drain, and the patient made an uneventful recovery. The anastomosis held, the child had bowel movements within twenty-four hours, and was comfortable. The child is being exposed to the sun every day and is doing very well. It is very unusual to have such an infiltrated tuberculous bowel hold and allow the anastomosis to heal.

We have done quite a number of cases under local anesthesia in young children when they have been extremely ill. We used to think this was impossible but we have been surprised to find how easy it is to keep the child interested during the operation.

DISCUSSION

DR. JOSEPH BRENNEMANN: How about the hemorrhages from the Meckel's diverticulum; how dark were they? I wonder if this has any diagnostic significance.

DR. STRAUSS: They were typical, dark, tarry color. I believe the bleeding is really very slow in these cases. They bleed slowly (much slower than a duodenal ulcer in the adult) and when the blood accumulates in the colon they have pain and cramps. The symptoms are practically that of duodenal ulcer in the adult and the bleeding is from an ulcer or two, usually in the dome of the diverticulum, where it is very vascular, due to collateral circulation from the organ with which it came in contact.

DR. JULIUS H. HESS: In this last case the clinical diagnosis rested between torsion of the intestine and intussusception. The distention of the abdomen was all in the upper half, the lower half being flat. The abdomen was not very sensitive and no tumor was palpable. Rectal examination was negative and no blood was noted on removal of the finger. No stools were passed during the preoperative period of observation. These findings led me to believe that we were not dealing with a case of intussusception but rather with a volvulus or primary thrombosis of the mesenteric vessels.

ENCYSTED EMPYEMA. Presented by DR. A. LEVINSON.

This is the same patient that I showed you last year, when there was a question as to whether it was an encysted empyema or a tumor mass. When the patient was first seen a year ago the dulness over the chest was limited to the fourth interspace. Roentgen-ray examination showed a mass over the upper portion of the left lobe which involved the lung tissue. Thoracentesis posteriorly revealed nothing, but anterior paracentesis in the second interspace resulted in gelatinous sterile pus. Later the child had measles and looked quite sick but did not have much increase in temperature. The surgeon decided to place a catheter in the fourth interspace. This catheter is still in the chest and the mother washes the cavity with a surgical solution of chlorinated soda twice a day. The last roentgen-ray examination showed a slight recovery of lung tissue, the density not being so marked as it formerly was. The temperature is usually 99.5 F. and the pus has always been sterile. Two cubic centimeters of pus were removed at the last irrigation. The child is not losing in weight. The Wassermann and Pirquet reactions are negative. We feel that it is a case of encysted empyema.

PYLORIC STENOSIS: This infant was 4 months old when first seen, and weighed 7 pounds, 4 ounces (3.4 kg.). The case had been diagnosed pyloric stenosis, because of the character of the peristaltic waves and the roentgen-ray examination. It was impossible to operate because of the general condition. The child was, therefore, given thick oatmeal water with the milk. The weight has increased and the mother says that there has been no vomiting for four weeks.

I do not believe the character of the peristaltic waves make a diagnosis of pyloric stenosis, and think it is a matter of judgment as to what type of case should and should not be operated on.

MEDIASTINAL TUMOR. Presented by DR. RALPH B. BETTMAN.

This boy, aged about 6½ years, was a full term, normally developed and normally delivered infant. He had no postnatal complications so far as we know.

He was brought to the hospital because of pain in the legs, of three months' duration, and pain in the back, which had started one week before. About four weeks before admission he had an attack of grip, and since then has been running a rather high temperature continuously. No swellings were noted at any time. There is a history of whooping cough at 4 years, but the history otherwise is negative.

When he was brought to the hospital on February 9, examination showed ragged tonsils and an inflamed pharynx. The cervical glands were palpable, especially the posterior group on the right side. There was a V-shaped flatness of the chest immediately behind the sternum, which extended from the clavicles to the fourth rib. At the second interspace it extended about 2 cm. to the left and 1 cm. to the right of the sternum. There was skodaic resonance to the left and below the flat area and slight harshness to the breath tones over the area of skodaic resonance. The temperature on entrance was 99.2 F., and there was a daily rise to 100 or 102 F., with an occasional rise to 103 F. The pulse on entrance was 100, respirations 28.

The urine, the Wassermann and Pirquet reactions and throat cultures were all negative. The white count ranged from about 25,600 to 33,300, hemoglobin was 85 per cent.

Roentgen-ray examination revealed a large, irregular shadow over the area of percussion dulness in the anterior mediastinum which varied greatly in intensity. No definite diagnosis could be made. The physical signs might well have been caused either by a mediastinal abscess or a mediastinal neoplasm.

As the child was rapidly growing worse it was impossible to drain the mediastinum without an incision and retraction of the pleura, and exploratory thoracotomy was considered indicated. The anesthetic was given with the usual oxygen nitrous oxid equipment, the pressure obtainable being sufficient to inflate the lung in case either or both pleural spaces had to be opened.

An incision was made just to the left of the sternum. The second and third costal cartilages were cut and the ribs retracted. The pleura was thus exposed, and by blunt dissection the left pleura was freed and carefully retracted. The ease with which the pleural sac could be pushed out of the way was surprising. The mediastinum now lay well exposed down to the pericardium. The mass was found to be composed of numerous firm nodules, some a centimeter, some several centimeters in diameter. The tumor extended around the great vessels. A section of tissue was removed for microscopic study. The wound was closed in layers and the patient returned to the ward in excellent condition.

Microscopic study proved the condition to be Hodgkins' disease.

Deep roentgen-ray therapy was immediately started and at present the child is receiving regular treatments.

The postoperative course is of interest. Almost immediately after the operation the general condition of the child improved. Although roentgen-ray treatments were not started for one week, the day after operation his temperature rose to 100 F. and has not been above that since. His appetite has improved, he is no longer apathetic and toxic, but is bright, up in a wheel chair and eager to walk. The glands in his neck, which at first were just barely palpable and no larger than we so often see in patients that have had frequent attacks of tonsillitis, began to swell and in spite of the roentgen-ray treatment are now large lumps on either side of the neck. His inguinal glands are palpable. A roentgenogram of the chest shows no diminution in the size of the shadow.

CHOREA. Presented by DR. JESSE R. GERSTLEY.

This is the season in which one sees many cases of chorea. It gives an opportunity of contrasting different methods of treatment. Four patients came into the hospital at about the same time and with symptoms of about the same severity. Although I have seen little in the literature concerning the effect of diet, on one I tried a high caloric diet, another was left on the routine ward feeding, and for the other two I tried the effect of serum, which Dr. E. C. Rosenow of Rochester, Minn., was kind enough to place at my disposal.

This girl has been on the high caloric diet. As you see she seems to have made a perfect recovery and in addition is in an excellent state of nutrition. The boy has been kept on the ordinary ward diet, has had no treatment except the usual rest in bed and seems to be doing very nicely.

The last two children have received serum. According to Dr. Rosenow's article, serum should be given intravenously. This was not practicable and so each of these two have received 10 c.c. intramuscularly for a period of six successive days.

The fourth child is one whose tonsils had been removed some years ago. If anything, her attack has been the most severe of the four. She developed a marked serum reaction, and following the disappearance of the urticarial rash, developed high fever and pains suggestive of neuritis. This all disappeared, however, in a few days.

It is too early to draw any conclusions as to the efficacy of the serum treatment. In the two patients treated, the benefit might be ascribed simply

to the rest in bed, but I wished to show these cases now to show the possibilities of this new treatment. Dr. Rosenow has written that he has a quantity of this serum on hand, and perhaps some of the other members of the society might also desire to give it a trial.

EVENTRATION OF THE DIAPHRAGM. Presented by DR. PHILIP ROSENBLUM.

This patient that Dr. Gerstley has been treating for chorea was first seen by me when it was 8 months old, because of cough, elevation of temperature and difficult respiration. At that time physical examination disclosed cardiac pulsation on the right side, with tympany in the lower left side of the chest and distant breath sounds on auscultation. At this time the child entered because of cough, elevation of temperature and labored breathing. This is the third attack of genuine bronchopneumonia; each time the patient made a complete recovery from the pneumonic process.

The roentgenogram shows the heart pushed to the right, and the left dome of the diaphragm pushed up into the left thorax with the stomach and intestines beneath.

This is apparently not a true hernia or a false hernia without a sac, but a true eventration of the diaphragm, with a thinning of the diaphragm on the left side. It is probably congenital in origin, due to a failure of development of the muscular elements of the diaphragm or of the phrenic nerve, rather than of the acquired type which occurs both as a complication to some acute infections, and following trauma to the neck in which the phrenic nerve has been involved.

GENERALIZED LUPUS ERYTHEMATOSUS AND INTRA-ABDOMINAL TUMOR. Presented by DR. JULIUS H. HESS.

This boy is 13 years old, and had a negative history until November, 1922, when he developed a typical lupus erythematosus of the face. In June, 1923, he went bathing and was badly sunburned, following which he developed a generalized rash, similar to the face rash, which covered the entire body. Dermatologists who have seen the boy state that such generalized lupus erythematosus is very rare.

In October, 1923, the boy suddenly developed pain in the epigastric region, and later free fluid in the abdomen. The pain was paroxysmal in character and no definite diagnosis was made. Due to the extreme prostration during attacks an exploratory laparotomy was performed. At operation two quarts of a straw colored fluid was withdrawn. The appendix was removed but showed no signs of inflammation. The peritoneum was normal and without evidence of tuberculous infection, which had been suspected.

The patient made a good recovery from the operation but after leaving the hospital the attacks of acute pain recurred. In December, 1923, he was taken to the Presbyterian Hospital and a second laparotomy was done. A low incision above the pubis was made and two quarts of fluid removed, but no pathologic change was noted other than a somewhat thickened peritoneum.

I first saw him about a month ago and at that time there was some fluid in the abdomen and in the pleural cavity. There was also a painful area at about the ninth dorsal vertebra. He was sent into the hospital and four days later we removed a quart and a half of fluid from the abdomen, and were then able to palpate a tumor mass in the epigastric region which extented to the right below the liver border. Palpation of the mass was very painful. The fluid had a specific gravity of 1,024 with 0.68 per cent. of albumin, 200 cells per cubic millimeter, all small lymphocytes. Smears and cultures were negative. Ten days later another tapping was done. The fluid had a specific gravity of 1,018.

We decided that the boy was not in a good condition for laparotomy and he was given a transfusion of 16 ounces (473 c.c.) of whole blood, following

which deep roentgen therapy was instituted. He was given a total of ninety minutes of treatment in five exposures on consecutive days. For several days he seemed to be greatly improved, with a return of appetite. At all times when the intra-abdominal pressure was not too great he could partake of solid foods without discomfort, but he experienced considerable difficulty in swallowing.

Repeated urine tests always showed a moderate amount of albumin, hyaline and granular casts, but no blood. There was at all times a moderate leukopenia, with a relative decrease in the neutrophils. Stools were negative for blood and parasites. Repeated tuberculin tests, both cutaneous and intradermal were negative and the Wassermann reaction was negative on three examinations made at different times. Most of the time he had a low grade temperature with occasional exacerbations. Roentgenologic examination showed retention in the esophagus, due to seeming interference with flow at a point just above the stomach, which was thought to be due to external pressure.

Laparotomy was performed April 8, 1924, through an incision above the umbilicus and in the median line. About two and one-half quarts of fluid was removed and a large tumor was found in the pancreatic region. It was attached to the vertebral column and seemingly involved the pancreas; several small areas of fat were noted.

The liver, kidneys, adrenals, stomach and intestines were seemingly not involved. The esophagus and stomach were stretched over the mass and probably accounted for the difficulty experienced in swallowing liquid food. Sections of the piece of tumor mass removed during the operation showed the following:

Section through the tissue shows it consists of a matrix of fat and fibrous tissue. Included in this there is one very definite histologic tubercle. There is also some necrotic material. Section through the skin: the epidermis is quite thick and is covered by a thin growing layer. Just beneath the malpighian layer there is a thin layer of pink hyalin staining tissue; beneath this the upper layers of the corium are very loose and have a myxomalike appearance. Beneath this there is a broad layer of firm fibrous tissue containing much blood extravasted in it. This is quite like the picture seen in myxedema.

The clinical diagnosis confirmed by laparotomy and removal of tissue for section is retroperitoneal tuberculous adenitis with secondary peripancreatitis and ascites.

The question raised, but still unanswered in our minds, is whether the skin infiltration and pigmentation might not be the secondary trophic changes following involvement of the abdominal sympathetic nervous system rather than a true lupus erythematosus.

DISCUSSION

Dr. Oscar T. Schultz: The cases that have been shown have brought up a number of points interesting to the pathologist. In the cases of Meckel's diverticula with hemorrhage shown by Dr. Strauss, he mentioned as a possible explanation of the bleeding the formation of adhesions with involvement of vessels. I wonder if that is the only explanation. Since such diverticula frequently contain heterotopic, gastric or duodenal mucosa, the question is raised whether one does not have in the bleeding Meckel's diverticulum what corresponds to a real peptic ulcer.

In regard to Dr. Bettman's case, our diagnosis was definitely Hodgkin's disease, in spite of the fact that it has not yielded to roentgen-ray therapy. The tissues were of the characteristic type one finds in the fibrotic stage of Hodgkin's disease. In view of the fact of the later enlargement of the cervical glands, in spite of roentgen-ray therapy, the whole process may be tuberculous or a combination of tuberculosis and Hodgkin's disease. The regional tissue was not that of lymphosarcoma, which has been suggested as a possibility.

Dr. Hess asked me to say a little about his case. The case shown by him is an example apparently of the precocity syndrome, in which there is abnormally

early somatic and sexual development. The lesion, in the cases of this group in which there has been an anatomic basis, has usually been in one of three systems, the gonads, the adrenal cortex or the pineal gland. In the literature, the majority of the patients in the adrenal and gonadal group have been in girls, whereas in the pineal gland group most of the patients have been boys The sex of Dr. Hess' patient, as well as the normal testes, which are as large as those of a boy aged 15 or 16 years, and the absence of any palpable abdominal tumor, would point to pineal gland involvement in that case. The type of involvement also speaks for that. In the pineal group there is not merely anatomic precocity, but actual functional precocity as well. When the syndrome occurs in girls and is associated with an adrenal tumor, it may be evidenced by very early menstruation, producing a condition of partial masculinization rather than true female precocity.

Presentation of Specimen from ATYPICAL LEUKEMIA. I was asked to say something of a pathologic nature, and have selected one of the group of blood diseases, which constitute for the pathologist the most interesting and baffling group in the entire field of pediatrics. The diseases of the blood-forming organs in children you are all familiar with, and know the great variety of conditions that may occur. From the anatomic standpoint we may have at one extreme the leukemias which are typical both anatomically and clinically, and at the other extreme characteristic examples of anemia. But between these extremes all sorts of conditions occur, which it is difficult to classify either clinically or anatomically. Ocasionally, the hematologic picture appears quite definite and permits clinical classification, but the necropsy findings are discordant. In other cases there may be a typical anatomic picture of leukemia, but the blood findings during life have been those of leukemia. Many names have been applied to the cases of this indefinite, intermediate group. Sternberg's leukosarcomatosis, aleukemic leukemia, pseudoleukemia infantum, von Jaksch's anemia are examples. These are, however, nothing more than names; they do not seem to represent definite entities. When applied, they may indicate some particular anatomic or clinical feature of an individual case, but they tell us little which permits any exact systematization of the entire group. In the indefinite group we would also have to include Hodgkin's disease, lymphosarcoma, benign lymphoma, and perhaps some of the cases termed clinically aplastic anemia. Hyperplastic changes in the bone marrow are frequent, and rarely there may be actual involvement of bone itself. Oesterlein[1] has recently reported a case of leukemia with widespread osteitis. Involvement of bone is the rule in chloroma, a condition which in other respects appears to be leukemia. The case from which I present a specimen is also an example of a blood disease with actual involvement of bone, but the osteitis is localized.

The patient, a girl, aged 5 years, was admitted to the hospital on December 5, and died December 26. The mother stated that at about the age of 1 year the child fell and bumped the right shin, and that this was followed by slight swelling. From that time on there were recurrent attacks of swelling, each attack being associated with some pain, but the swelling never became very marked. At the time of admission to the hospital, the mother stated that the swelling had recurred about a month before and was associated with pain which was periodic in character. There was nothing of note in the physical examination, and while the swelling of the tibia was visible it was not pronounced. The greatest interest attaches to the blood picture. On admission, the red count was 1,112,000, with 55 per cent. hemoglobin, and a leukocyte count of only 3,200. The differential count showed only 9 per cent. neutrophils, with a high mononuclear count, and 4 per cent. myelocytes. From that time on repeated blood examinations were made. The white count was always low, dropping to 2,000 and below on a number of occasions, and the red cells

1. Oesterlein: Virchow's Arch. f. path. Anat. **247**:589, 1924.

showed the changes which occur in anemia, with a color index always greater than 1. There were occasionally a few nucleated red cells, but these finally disappeared. Clinically, the case looked like an aplastic anemia but without the hemorrhages.

The child developed a vesicular eruption over the abdomen a few days before death, and at necropsy numerous petechial hemorrhages were found scattered through the kidney and its capsule.

The roentgenogram of the tibia showed surprisingly little change. The roentgenologist's report was "slight thickening of the periosteum," but there did not appear to be any involvement of the bone itself. It is difficult to correlate such a roentgen-ray picture with the bone specimen itself, which I present. A reduced marrow cavity is filled with what we considered fatty, aplastic marrow. About this is a zone of dense pale bone, which averages about 5 mm. in thickness, and which appears to be the original cortex of the bone. Outside this is a second, very sharply defined layer of bone which averages 2 mm. in thickness. This layer is also quite dense. Microscopically it is composed of bone trabeculae arranged radially to the underlying thicker layer of denser bone. The spaces between the trabeculae are filled with young granulation tissue. Externally, the bone is covered by a slightly thickened, fibrous periosteum. The marrow, microscopically, is composed of closely placed, large, oval and round cells, whose nature cannot be determined because this entire cellular area is necrotic, apparently as the result of infarction. At the periphery of the necrotic tissue is a thin zone of loose, young connective tissue which contains a few large cells, apparently myelocytes and myeloblasts.

The question arises as to the relation of the localized bone changes in the tibia to the general blood and anatomic picture. We were at first inclined to consider the bone involvement as an independent process and probably a chronic osteitis following an injury. The general condition was thought to be probably an aplastic anemia. The mesenteric lymph nodes and the lymph nodes in general were slightly enlarged and moderately congested. The spleen was only slightly enlarged. Microscopic examination revealed a diffuse hyperplasia of the lymph nodes, with the presence of many cells of the myelocyte type. Similar cells were present diffusely in the spleen. Moderate myelocytic infiltration was present in the interlobular tissue of the liver, about the glomeruli of the kidney, and diffusely in one ovary. The bone marrow, elsewhere than in the involved tibia, showed only a slight grade of cellular hyperplasia.

To summarize, then, we can say that the blood picture was that of an aplastic anemia. The general anatomic picture was one of moderate myelocytic hyperplasia of the lymphoid tissues, the spleen and the marrow. In addition, there was the area of localized, more marked marrow hyperplasia of the tibia, with an actual osteitis. We believe that the involvement of the tibia was part of the general process, and for purposes of classification we have termed the case one of aleukemic leukemia. But we frankly admit that this term does not mean anything very definite, and that it covers a considerable amount of ignorance of the genesis and actual nature of this particular case.

Regular Meeting, April 15, 1924

H. W. CHENEY, M.D., *President*

The April meeting of the Chicago Pediatric Society was held at the City Club on Tuesday. A dinner was served at 6:30 for members and friends, at which Prof. H. Finkelstein, of Berlin, was the guest of honor.

Following the dinner the President called on Dr. I. A. Abt to introduce the guest of honor. Dr. Abt's remarks were most appropriate, in that they sum-

marized the achievements of Professor Finkelstein and emphasized his prominent position in the pediatric world.

Professor Finkelstein then addressed the Society. He stated that though he had been asked to speak on matters of pediatric interest on this occasion, he preferred to present "a mixture of one part pediatrics, diluted with two parts of general impressions, without additional sugar, because the impressions in themselves are sufficiently sweet."

Professor Finkelstein's words were most human and interesting, showing a keen sense of humor and delivered in a most fascinating manner. The progress in pediatrics and child welfare work in America had greatly impressed him and he felt that America would soon "be at the front of pediatrics."

In closing, he said, "Your country and your mankind appear to me like a powerful young giant, conscious of his strength, and of his abilities and ready to overcome the globe. No doubt this giant will thrive and develop and his deeds will astonish the world, and they will give evidence not only of his strength, but also of his reason, his generosity and his kindness."